

THE PEDAGOGICAL SEMINARY AND  
**JOURNAL OF  
GENETIC PSYCHOLOGY**

Child Behavior, Animal Behavior,  
and Comparative Psychology

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## THE SOLVING OF PROBLEM-SITUATIONS BY THE PRESCHOOL CHILD\*

*Department of Child Development, Texas Technological College*

BING-CHUNG LING<sup>1</sup>

### A. INTRODUCTION

This experiment is a part of the comprehensive research entitled "*The Psychophysical Development of the Preschool Child*." The technique employed in this experiment is an adaptation of the procedure used by Augusta Alpert in her study of "*The Solving of Problem-Situations by Preschool Children*" (1), and by Kurt Gottschaldt in "*Der Aufbau des Kindlichen Handelns*" (2). It was devised not only to verify the findings of these authors, but primarily to approach the preschool child from as many angles as possible under carefully controlled conditions in order to gain a deeper understanding of the rapid and integrating process of his development.

### B. PURPOSE

The purpose of the investigation was to study the solving behavior of the preschool child when confronted with problem-situations.

### C. PROCEDURE

#### 1. *Problem-Situations*

Two series of problem-situations were devised. In Series I the subject was free to move around in the experimental room, but the goal was invariably placed beyond the subject's reach so that he had to utilize some object in the room as a "tool" to aid him in the attainment of the goal. In Series II the subject was placed inside of a play-pen and the goal outside of the pen beyond the maximum reaching length of the subject. In order to

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<sup>1</sup>The writer wishes to express her indebtedness to Dr. Robert C. Goodwin, Director of Scientific Research; Drs. William C. Holden and Harry L. Kent, members of the Research Committee; Miss Margaret W. Weeks, Dean of Division of Home Economics; Miss Jonnie H. McCrery, Head of Department of Foods and Nutrition; and Miss Sannie Callan, Head of Department of Child Development and Family Relations, for making available to her the resources for the investigation at Texas Technological College Nursery School. She is particularly grateful to Miss McCrery for her active interest and encouragement throughout the experiment. She also wishes to thank Miss Ouida Johnston, a Senior in the Division of Home Economics, for her competent assistance in the research.

attain the goal the child again had to improvise a "tool" out of some object within his reach. In both experimental series then, the subject was confronted with problem situations the solution of which depended entirely upon his ability to utilize available objects as "tools" in his attainment of the goals.

Each of the two series of experiments consisted of five problem situations as follows:

*a. Series I.*

(1). *Situation A* (Figure 1). This situation was devised solely for the purpose of establishing in the subject the habit of reaching for the

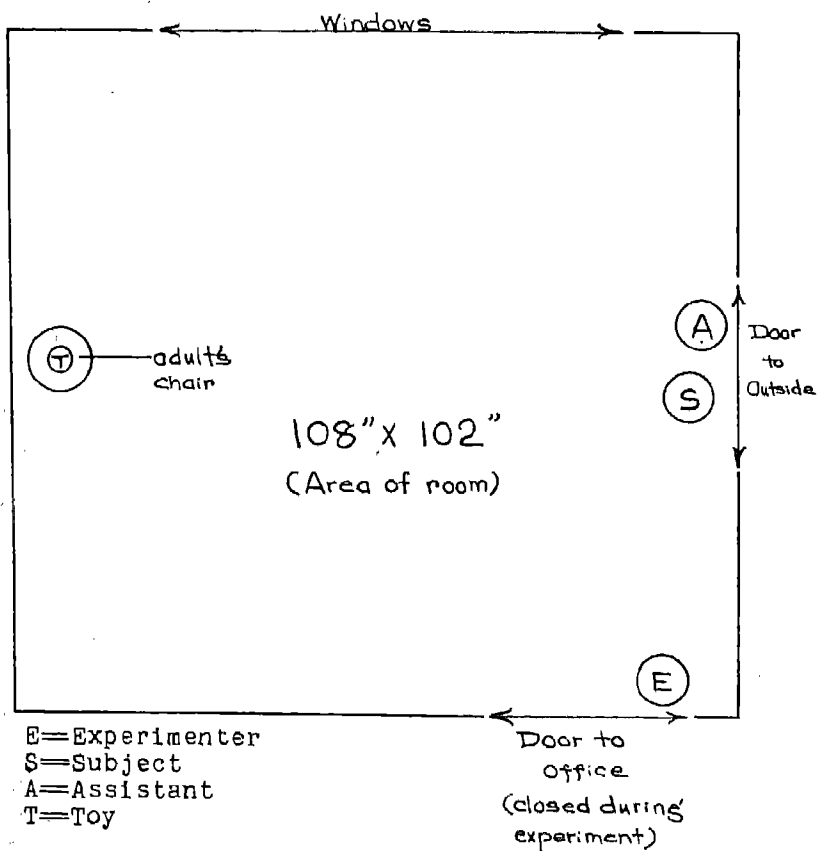


FIGURE 1  
DIAGRAM OF THE EXPERIMENTAL SET-UP IN SERIES I, SITUATION A

goal. It presented no problem, but simply served to orient the subject to the series.

An attractive toy,<sup>2</sup> novel to the subject, was placed on an adult's chair at the far end of the room. All the child had to do was to go to the chair and reach for the toy.

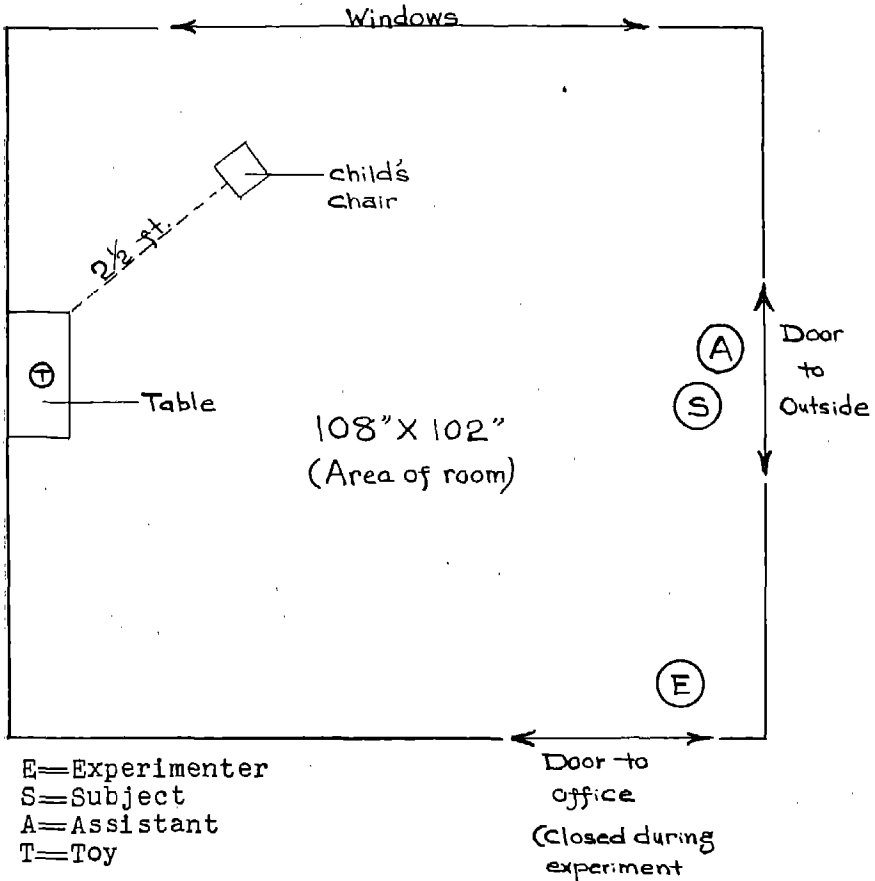


FIGURE 2

DIAGRAM OF THE EXPERIMENTAL SET-UP IN SERIES I, SITUATION B

<sup>2</sup>In this situation, as well as in all the other situations, the specific toy used varied with the preference of each individual child. The criterion for the selection of the toy was, therefore, based upon the attractiveness of a given toy for a given subject at a given time rather than upon the preference of the experimental children as a group.

(2). *Situation B* (Figure 2). A variegated mechanical toy, set in motion, was placed on a small oblong table 50 inches from the floor. The table occupied the same position in the experimental room as the chair in *Situation A*. A child's chair was placed  $2\frac{1}{2}$  feet diagonally to the right of the table. In order to secure the toy, the subject must: first, move the chair to the table; and second, use the chair as a footstool in reaching.

(3). *Situation C* (Figure 3). An attractive toy was suspended from the ceiling in the middle of the experimental room by means of a shiny brass hook and a red cord so that it was just a little above the maximum reaching

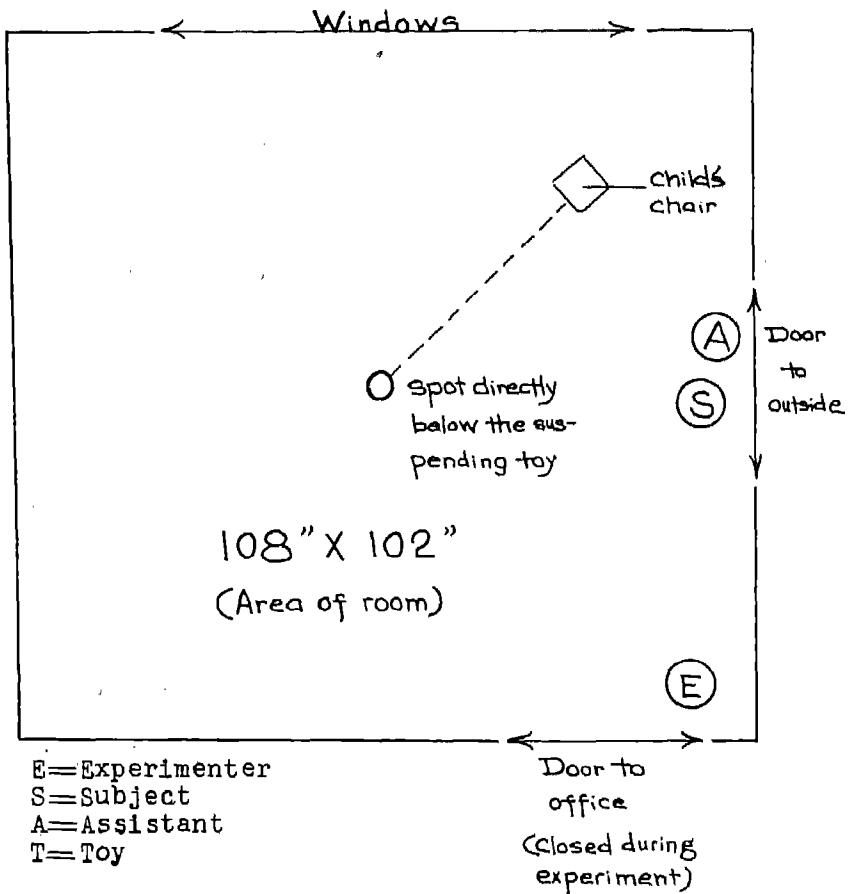


FIGURE 3  
DIAGRAM OF THE EXPERIMENTAL SET-UP IN SERIES I, SITUATION C

height of the subject. A child's chair was placed three feet diagonally to the right of the suspended lure. The solution of the problem depended upon the subject's ability to move the chair to a spot directly below the goal and then to use it as a footstool in reaching.

(4). *Situation D* (Figure 4). In this situation the lure occupied the same position in the experimental room as in *Situation C* except that the suspending cord was made three inches shorter. A platform of two steps, consisting of two rises (lower rise, 7 by 18 inches; upper rise, 6 by 18 inches) one tread (8 by 18 inches) and one platform at the top ( $11\frac{1}{2}$  by 18 inches),

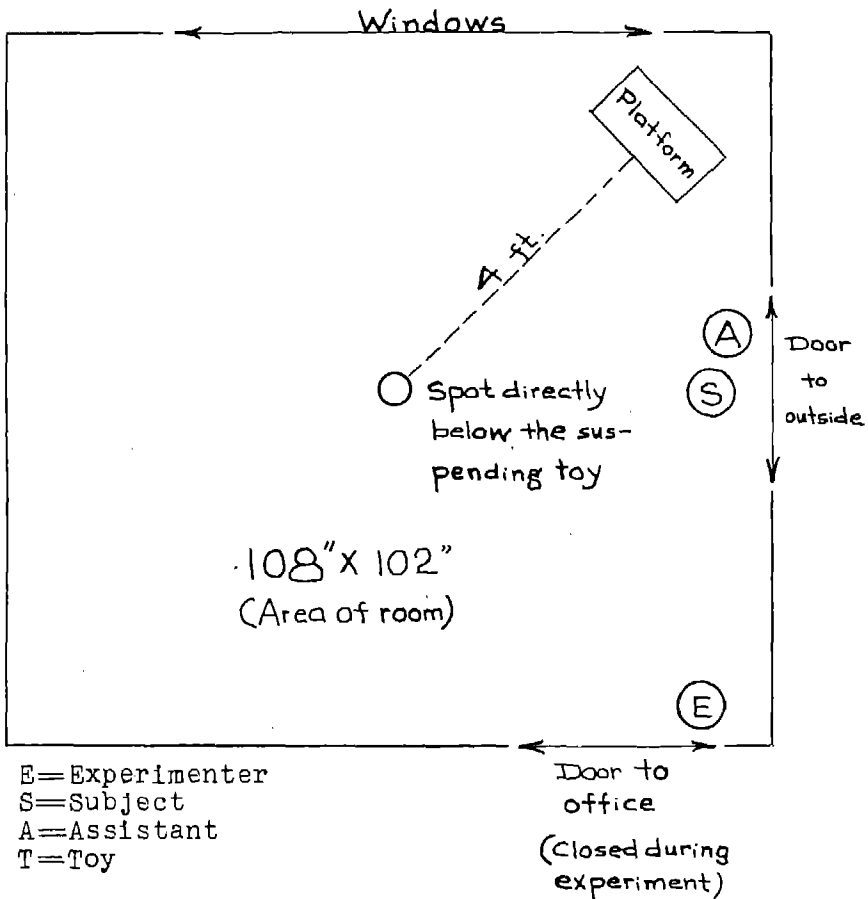


FIGURE 4

DIAGRAM OF THE EXPERIMENTAL SET-UP IN SERIES I, SITUATION D

was placed in a corner four feet diagonally to the right of the toy. As the child stood at the entrance to the experimental room facing the lure, the platform was definitely outside his visual field. In order to attain the goal the subject had to find the platform, move it to a spot directly below the suspended toy, and then use it as a footstool in reaching.

(5). *Situation E* (Figure 5). In this situation the lure occupied the same position in the experimental room as in Situations *C* and *D* except that the suspending cord was made another three inches shorter. The platform

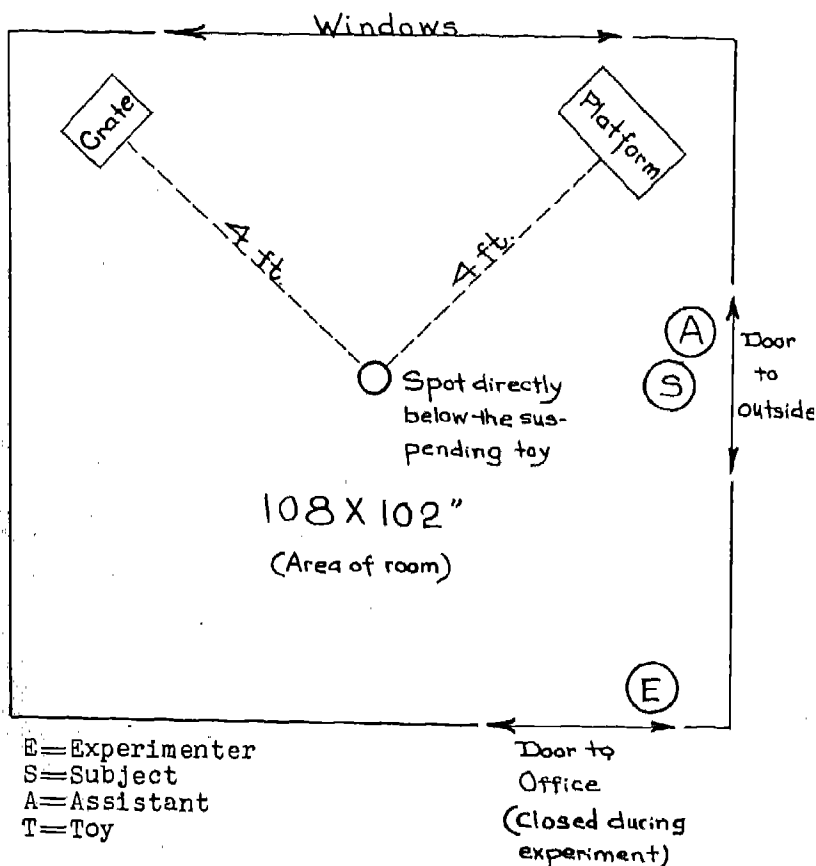


FIGURE 5  
DIAGRAM OF THE EXPERIMENTAL SET-UP IN SERIES I, SITUATION E

was left in the same position in the room as in the preceding situation. A re-enforced and closed-in orange-crate was placed in another corner of the room four feet diagonally to the left of the toy. As the subject stood at the entrance to the room facing the suspended toy, the platform was definitely outside his visual field, while the orange-crate was very much at the background of his field of visual perception. The solution of the problem depended upon the subject's success in finding both of the "tool" objects, move them to a spot directly below the lure, and put them side by side in such a way as to make a ladder of three steps which he could mount in his reaching for the suspended toy.

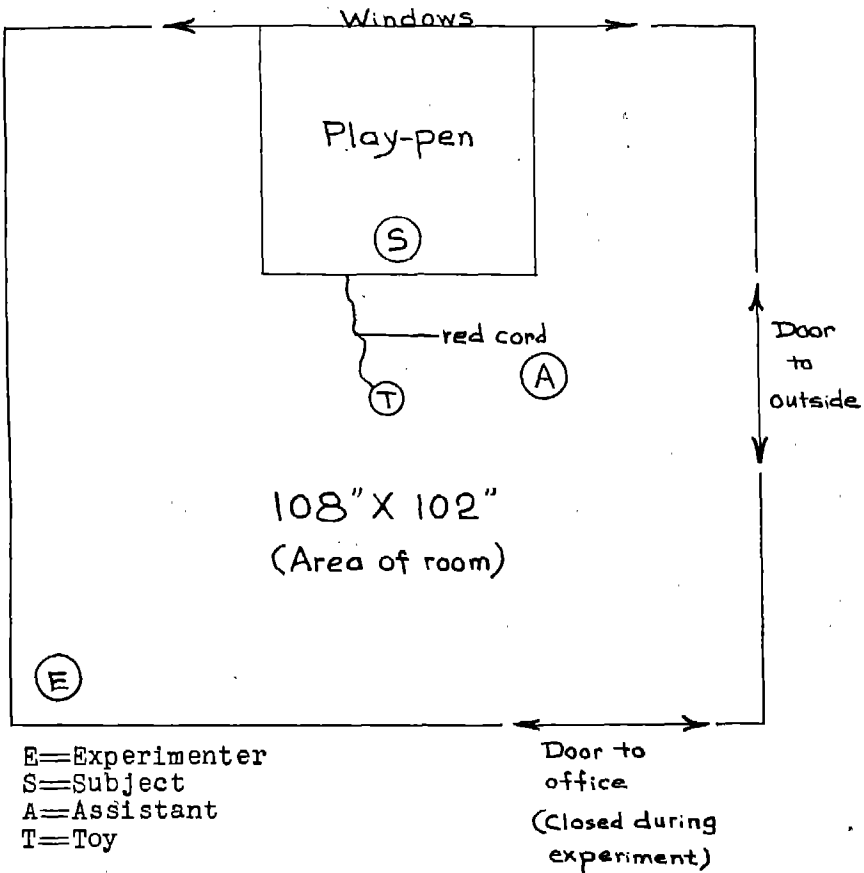


FIGURE 6

DIAGRAM OF THE EXPERIMENTAL SET-UP IN SERIES II, SITUATION A

*b. Series II.*

(1). *Situation A* (Figure 6). Like Series I, *Situation A*, the present situation sought to establish in the subject the habit of reaching out from inside an area of "confinement" for the goal which was outside of the area. It presented no real problem, but simply served to initiate the child into the second series of experiments.

A play-pen, 40 by 40 by 24 inches in dimension, with a sea-green floor and a cream-colored railing on all four sides, was placed against the windows at the north end of the experimental room. An attractive toy was laid on the floor outside of the pen at a distance definitely beyond the maximum forward

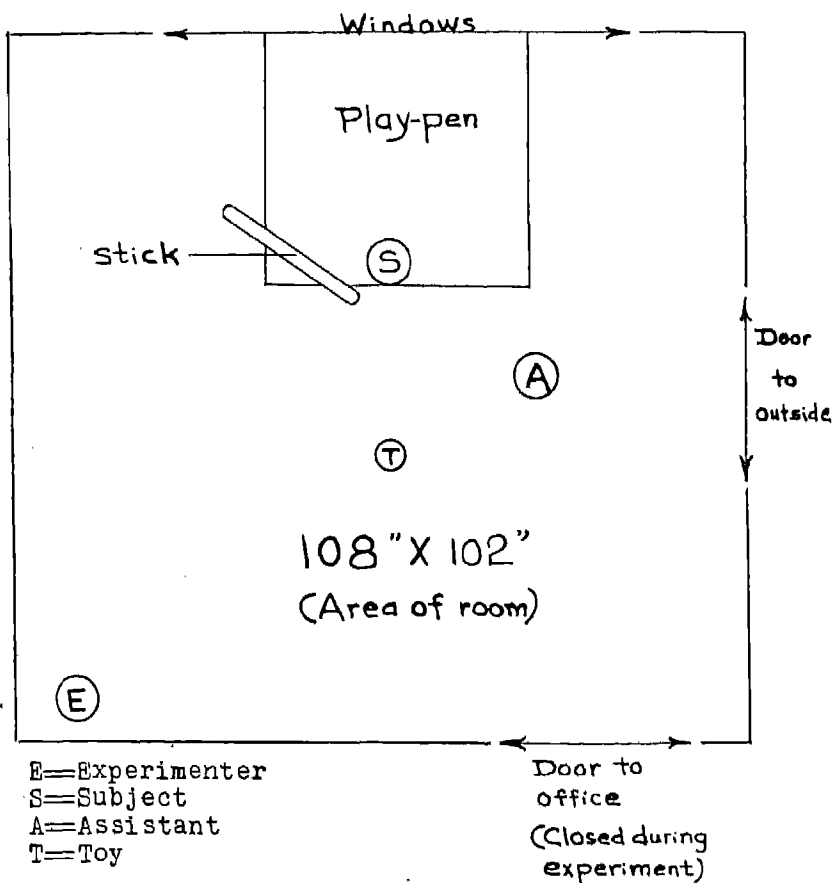


FIGURE 7  
DIAGRAM OF THE EXPERIMENTAL SET-UP IN SERIES II, SITUATION B

reaching distance of the subject. A red cord connected the toy with the front railing of the pen. By pulling in the cord the subject was able to secure the toy with ease.

(2). *Situation B* (Figure 7). The same play-pen was used. On the right front corner of the pen, a wooden stick: length,  $24\frac{1}{2}$  inches; diameter,  $\frac{7}{8}$  inch; and wound with bright red paper and string to render it conspicuous, was placed diagonally across the front and right railings. As soon as the subject was stationed in the play-pen, an attractive toy was placed on the floor outside of the play-pen and facing the subject. It was well

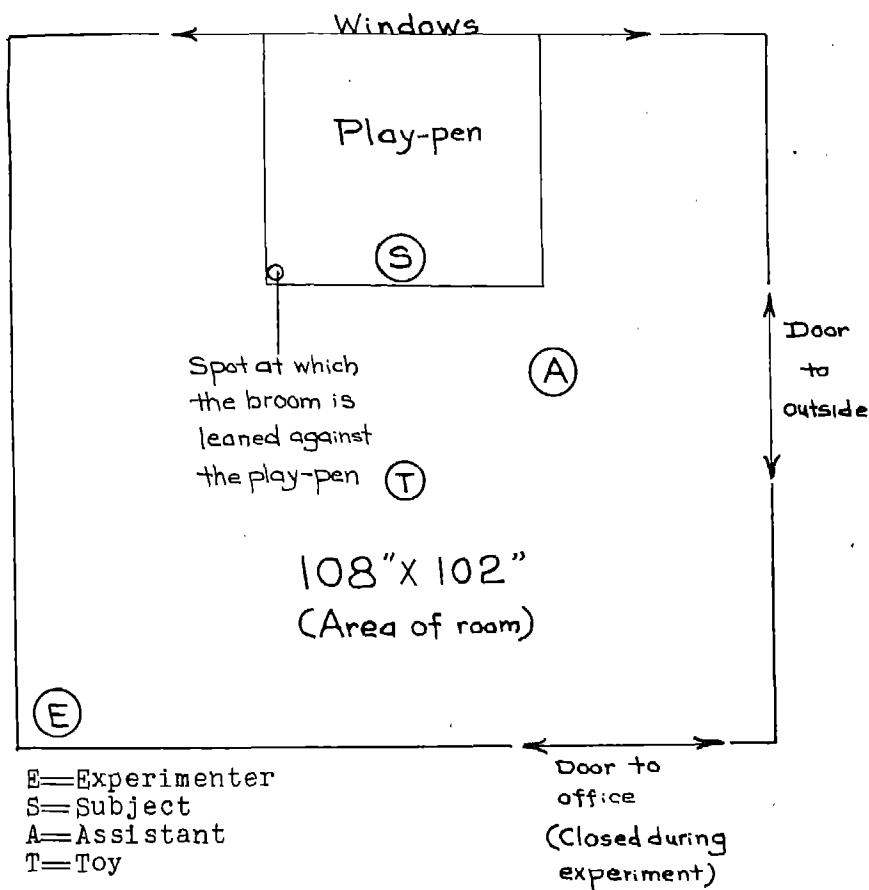


FIGURE 8

DIAGRAM OF THE EXPERIMENTAL SET-UP IN SERIES II, SITUATION C

beyond his maximum reaching length. In order to secure it the child must utilize the stick as an aid in reaching.

(3). *Situation C* (Figure 8). The same play-pen was used. Against the right front corner of the pen was leaned, right side up, a toy broom, 32 inches long. Its brush of broom corn was 11 inches in length and  $6\frac{1}{2}$  inches wide at its base. Its bright red wooden handle was 21 inches long and  $\frac{3}{4}$  inch in diameter. It was capped with chromium, which made it more or less slippery and, therefore, unsuitable for drawing or pulling objects. As soon as the subject was placed in the play-pen, an attractive lure was put on the floor outside of the pen and facing the child. It was well beyond his

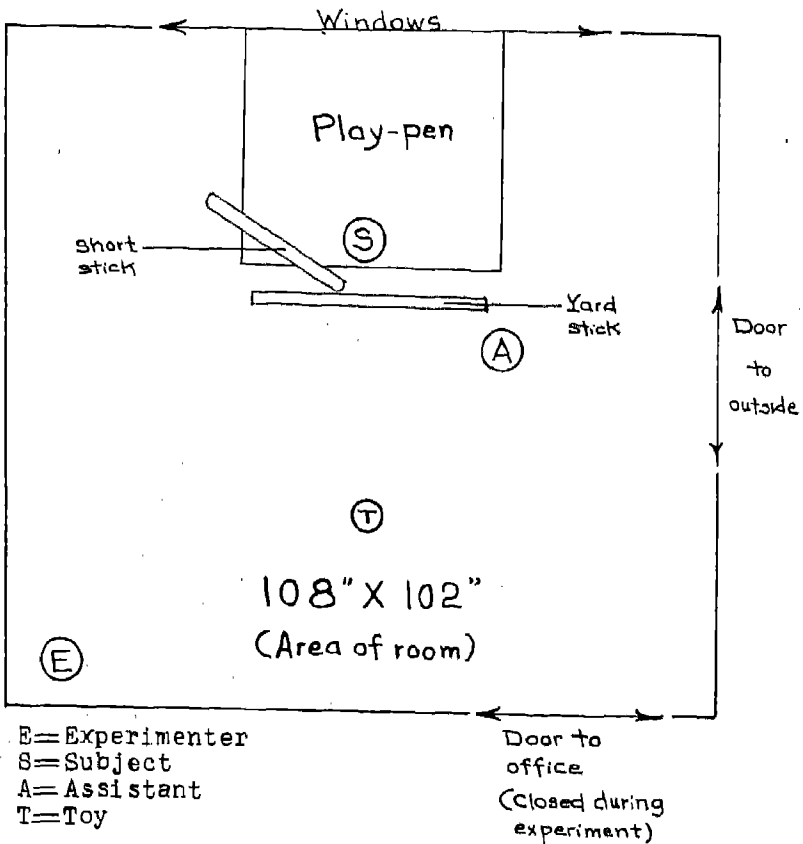


FIGURE 9

DIAGRAM OF THE EXPERIMENTAL SET-UP IN SERIES II, SITUATION D

maximum forward reaching distance. To procure it the subject must sweep it toward himself with the broom.

(4). *Situation D* (Figure 9). The same play-pen was used. In the right front corner of the pen, diagonally across the railings, was placed the same stick used in Series II, Situation B. On the floor outside of the pen; just beyond the maximum reaching length of the subject, was placed a yard stick, likewise wound with bright red paper and strings, and parallel with the front railing of the pen. An attractive toy was placed on the floor outside the play-pen far beyond the reaching length of the subject. The attainment

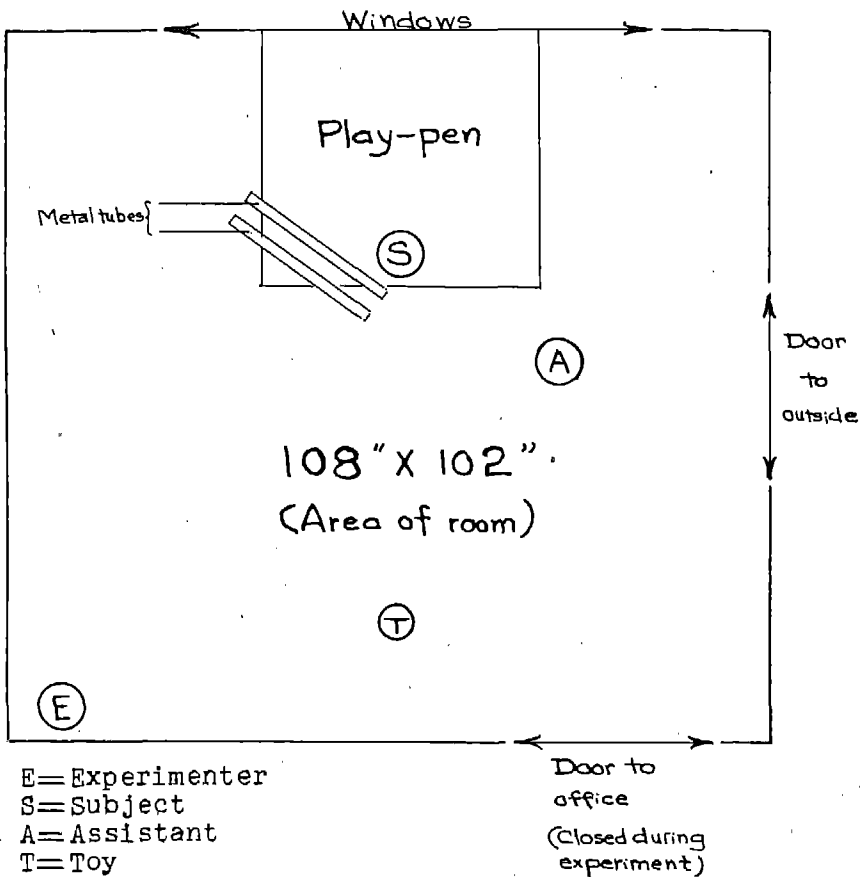


FIGURE 10

DIAGRAM OF THE EXPERIMENTAL SET-UP IN SERIES II, SITUATION E

of the goal hinged upon three successive acts on the part of the child: first, he must secure the short stick on the railings; second, he must obtain the yard stick by means of the short stick; and third, he must reach for the toy with the yard stick.

(5). *Situation E* (Figure 10). The same play-pen was used. In the right front corner of the pen, two light metal tubes, 21 inches long, and painted red and white, were placed diagonally across the railings. One of the tubes was  $7/16$  inch in diameter. The diameter of the other tube was  $1/16$  inch smaller so that when the tubes were pushed one slightly into the other, the end of the smaller tube fitted snugly into the end of the larger tube, thus forming one long stick.

As soon as the subject took his position inside the play-pen, an attractive toy was placed on the floor outside. It was so far away from him that in order to secure it he must use the long stick made by the insertion of the end of the smaller tube into the end of the larger tube in the manner described above.

## 2. General Technique

The subjects were always tested in the morning between nine and ten o'clock in the same room in the College Nursery School. The duration of the experiments ranged from 15 minutes to 20 seconds. It was determined by the subject's apparent interest in the problem, the speed of his solution, and the factor of fatigue.

The subject entered the experimental room with the assistant, who not only fetched the child, but also conducted the experiment under the experimenter's direction. This relieved the latter of routine experimental procedure so that she might devote her time to observation and note-taking which were especially important in this type of experiment.

In a series of preliminary tests in which nursery school children, not participating in the main experiment, served, a system of statements to be spoken to the subject were formulated and tested. For the Series I experiments, as soon as the child entered the experiment room, the assistant would say, "*See the (name of the toy). Can you get it? You may play with it if you can get it all by yourself.*" Later when the child showed first signs of frustration and discouragement, the assistant would say, "*Can you find something which will help you to get (name of the toy)?*" Still later if the child continued to be baffled and helpless, the assistant would say, "*Look around to see if you can find something which will help you to get (name of the toy).*"

For the Series II experiments the second and third statements remained unchanged. The first statement was as follows: "*This is your little house* (referring to the play-pen). *The* (name of the toy) *is outside of the house. Can you get it? You may play with it if you can get it from inside the house.*"

Any of the above formulae might be repeated as often as was deemed necessary. However, no variation in the wording of it was permitted. Neither was it to be used before the full attention of the child was secured.

The experimenter sat as unobtrusively as possible in a low chair in one corner of the experimental room outside of the direct vision of the subject. Except on very rare occasions when the assistant was baffled as to the proper procedure, the experimenter devoted herself solely to quiet observation and note-taking. As all the nursery school children of Texas Technological College were accustomed to seeing students of the child development class sitting in a corner, observing and taking notes, the present experimental set-up was less disturbing than it would have been under ordinary circumstances.<sup>3</sup> The fact that the experimenter was well known to all the subjects also helped to reduce the element of distraction to a minimum.

Situations *A* in both of the experimental series required no solution. In all the other situations the subject was given three trials—usually extending over 10 days—to solve the problem. In each trial the condition was kept constant. The experiments were given in the order of increasing difficulty as presented under "Problem-Situations." When a child failed to solve a given problem in Series I at the end of the third trial, he was dropped from all the subsequent situations of the series and initiated into Series II. If he failed again in a given situation in the second series, he was dropped from the entire experiment.

So far as possible, the experimenter sought to keep the intervals between trials constant for all the subjects. However, owing to frequent absences from school and also owing to the rather violent emotional disturbances in the face of failures on the part of some of the subjects, it was deemed wise to admit the subject to the experiment only when he was positively and pleasantly inclined. In this way a maximum amount of coöperation from the subject was at least made possible.

Throughout the experiment not only the experimenter, but the assistant also, sought to render herself as inconspicuous as possible. The subject's

<sup>3</sup>While planning for the present experiments, the experimenter had attempted to order some copper wire screening to make a one-way vision screen. However, owing to war-time scarcities she had to forego the original plan and resort to the use of the less controlled technique employed here.

persistent complaints and questions were answered briefly and in a matter-of-fact manner. His rambling chatters were unheeded. As far as was practicable, the prescribed formulae, described previously, were the only form of verbal intercourse held between the subject and the assistant. However, at the close of the experiment the child who had succeeded was liberally praised while the one who had failed was encouraged to hope for success during the next trial. In both cases the subject was asked to return and play with some other toys another day.

#### D. SUBJECTS

Eight children from the Nursery School of Texas Technological College participated in the experiment. They ranged in age from 2 years 2 months to 3 years 7 months at the beginning of the present study. Three of them were girls; the rest boys. All of them came from professional or semi-professional homes, and were normal or supernormal in their mental and physical development.

#### E. RESULTS

The experimenter's running account of the subjects' solving behavior in the 10 test-situations (eight of which were problem-situations) described above, constituted the sole available record of the results of the present study.\* It included the following data: (*a*) case number, (*b*) name of subject, (*c*) date of experiment, (*d*) age of subject, (*e*) duration of trial, (*f*) length of interval between trials, (*g*) number of trials required for solution, (*h*) solving behavior of subject, and (*i*) subject's remarks whenever they threw light on the solving process.

\*These data were analyzed under the following headings: (*a*) Achievement Scores, (*b*) Responses to Problem-Situations, (*c*) Types of Solution, (*d*) Failures and Their Causes, (*e*) Retention and Transfer, (*f*) Duration of Trials, and (*g*) Intervals between Trials.

##### 1. *Achievement Scores*

Tables 1 and 2 give the achievement score of each subject in each problem-situation in Series I and II respectively. Of the eight subjects, three solved all the eight problems; one failed in every case; one succeeded completely in Series I, but failed completely in Series II; one failed completely in Series I, but succeeded completely in Series II; the remaining two solved all but the

---

\*In an analytic, qualitative study such as this there is no doubt that cinema records of the subjects' performances would be of real value.

TABLE 1  
SUCCESS OR FAILURE OF EACH SUBJECT IN EACH PROBLEM—SITUATION IN SERIES I,  
INCLUDING HIS AGE AND SEX, AND THE NUMBER OF TRIALS HE WAS  
GIVEN FOR THE SOLUTION OF THE PROBLEM

		Problem-situations				
Case No.	Sex	A	B	C	D	E
I	F	Success 1 trial 2 yrs. 2 mos.	Success 3 trials 2 yrs. 2 mos.	Success 2 trials 2 yrs. 3 mos.	Success 1 trial 2 yrs. 3 mos.	Success 1 trial 2 yrs. 3 mos.
II	M	Success 1 trial 3 yrs. 3 mos.	Success 1 trial 3 yrs. 3 mos.	Success 1 trial 3 yrs. 3 mos.	Success 3 trials 3 yrs. 3 mos. to 3 yrs. 4 mos.	Success 1 trial 3 yrs. 5 mos.
III	M	Success 1 trial 3 yrs. 7 mos.	Success 1 trial 3 yrs. 8 mos.	Success 1 trial 3 yrs. 8 mos.	Success 1 trial 3 yrs. 8 mos.	Success 1 trial 3 yrs. 8 mos.
IV	F	Success 1 trial 3 yrs. 4 mos.	Success 1 trial 3 yrs. 4 mos.	Success 1 trial 3 yrs. 5 mos.	Success 1 trial 3 yrs. 5 mos.	Success 1 trial 3 yrs. 5 mos.
V	F	Success 1 trial 3 yrs. 2 mos.	Failure 3 trials 3 yrs. 3 mos.			
VI	M	Success 1 trial 3 yrs. 4 mos.	Failure 3 trials 3 yrs. 4 mos.			
VII	M	Success 1 trial 3 yrs. 6 mos.	Success 1 trial 3 yrs. 6 mos.	Success 1 trial 3 yrs. 6 mos.	Success 1 trial 3 yrs. 6 mos.	Success 1 trial 3 yrs. 6 mos.
VIII	M	Success 1 trial 3 yrs. 3 mos.	Success 1 trial 3 yrs. 3 mos.	Success 1 trial 3 yrs. 3 mos.	Success 1 trial 3 yrs. 4 mos.	Success 1 trial 3 yrs. 4 mos.

very last problems (Series II. Situation E). These data reveal very interesting individual differences in problem-solving.

The same tables also show that the total number of trials given for the solution of Series I problem-situations was 35; that given for the solution of Series II problem-situations was 37. Furthermore, in Series I the average initial age for the subjects was 3 years 25 $\frac{5}{8}$  months; their average final age was 3 years 3 $\frac{1}{4}$  months. In Series II the average initial age for the subjects was 3 years and 3 $\frac{1}{2}$  months; their average final age was 3 years 4 months. Despite the fact that all the subjects were older and more experienced when confronted with the problem-situations of Series II than when exposed to those of the first series, more cases passed all the tests of

TABLE 2  
SUCCESS OR FAILURE OF EACH SUBJECT IN EACH PROBLEM—SITUATION IN SERIES II,  
INCLUDING HIS AGE AND SEX, AND THE NUMBER OF TRIALS HE WAS  
GIVEN FOR THE SOLUTION OF THE PROBLEM

Case No.	Sex	Problem-situations				
		A	B	C	D	E
I	F	Success 1 trial 2 yrs. 3 mos.	Failure 3 trials 2 yrs. 3 mos.			
II	M	Success 1 trial 3 yrs. 5 mos.	Success 1 trial 3 yrs. 5 mos.	Success 1 trial 3 yrs. 5 mos.	Success 1 trial 3 yrs. 5 mos.	Success 1 trial 3 yrs. 5 mos.
III	M	Success 1 trial 3 yrs. 8 mos.	Success 1 trial 3 yrs. 8 mos.	Success 1 trial 3 yrs. 8 mos.	Success 1 trial 3 yrs. 8 mos.	Success 1 trial 3 yrs. 8 mos.
IV	F	Success 1 trial 3 yrs. 5 mos.	Success 1 trial 3 yrs. 5 mos.	Success 1 trial 3 yrs. 5 mos.	Success 1 trial 3 yrs. 5 mos.	Failure 3 trials 3 yrs. 6 mos.
V	F	Success 1 trial 3 yrs. 3 mos.	Success 3 trials 3 yrs. 3 mos. to 3 yrs. 4 mos.	Success 1 trial 3 yrs. 4 mos.	Success 1 trial 3 yrs. 4 mos.	Success 2 trials 3 yrs. 4 mos. to 3 yrs. 5 mos.
VI	M	Success 1 trial 3 yrs. 5 mos.	Failure 3 trials 3 yrs. 5 mos.			
VII	M	Success 1 trial 3 yrs. 7 mos.	Success 1 trial 3 yrs. 7 mos.	Success 1 trial 3 yrs. 7 mos.	Success 1 trial 3 yrs. 7 mos.	Success 1 trial 3 yrs. 7 mos.
VIII	M	Success 1 trial 3 yrs. 4 mos.	Success 1 trial 3 yrs. 4 mos.	Success 1 trial 3 yrs. 4 mos.	Success 1 trial 3 yrs. 4 mos.	Failure 3 trials 3 yrs. 4 mos. to 3 yrs. 5 mos.

Series I and with less number of trials than they did the tests of Series II. All this indicated very strongly that the problem-situations of Series II in which relatively finer muscular coördination was required of the subject for the solution were genetically more advanced forms of tests than those of Series I in which grosser motor coördination was necessary.

## 2. Responses to Problem-Situations

Although the number of cases included in the present study was very small, the kinds of responses given by the subjects when confronted with the eight above-described problem-situations were sufficiently varied to confirm the

findings of Alpert (1). These responses may be classified into five groups.

*a. Negative response.* The subject made no attempt whatever to solve the problem. He stood motionlessly in the experimental room. His intense stare at the lure betrayed his interest in the objective, but his interest never went beyond silent, or sometimes sullen, watching of the toy. Occasionally when this negative reaction was allowed to continue too long, the subject would burst in tears.

*b. Substitutional reaction.* After the subject had repeatedly tried in vain to attain his goal, he became engaged in some form of substitutional reaction which for the time being occupied the center of his attention. This happened more frequently with younger than with older subjects. The most common forms of such substitutional reaction were playing with the beads in the side railings of the play-pen, raising and lowering window shades, handling the subject's own clothing, particularly buttons, and thumb sucking.

*c. Primitive reaching.* Upon entering the experimental room, without looking around for any "tool" objects, the subject reached directly for the lure with his bare hand or hands. This happened not only during the early part of the investigation, but also frequently after the child had become fully acquainted with the idea of using "tools" as an aid in his attainment of the goal. The act suggested strongly that the child did it in spite of himself without forethought or careful judgment. Again, this same primitive reaching occurred when the subject, having failed in every attempt to secure the toy, found himself face to face with an insoluble problem.

*d. Trial and error.* With his attention riveted upon the objective, the subject tried out one possibility after another in his attempts to secure the toy. Occasionally this type of response was guided by the subject's partial understanding of the problem involved, but more frequently it was a process of exploration and elimination until by accident the solution was hit upon and the objective attained.

*e. Immediate solution.* The subject went after the objective and secured it with such directness that apparently no problem existed for him. This type of act often called forth from the assistant the naïve comment that the child knew what to do all the time.

### 3. Types of Solution

In the preceding paragraphs attention has been called to all types of responses, both successful and unsuccessful, which the subjects exhibited when exposed to the problem-situations heretofore described. In the present section

only successful responses—responses which brought about the desired end; namely, the securing of the lure—will be taken up and further analyzed.

It has been conclusively shown by the works of Köhler (4), Koffka (3), Alpert (1), and others, and amply supported by the results of the present study, that in order to solve the problem in a given situation, the subject must see the relatedness of parts of the whole. In Series I, Situation *E*, for example, the child must perceive the functional relationship among the toy, the platform, the orange-crate, and himself before he could secure the toy with the aid of the combination of the two "tool" objects. Otherwise, although the child stumbled over the platform and fell upon the crate accidentally in his excited roving in the experimental room and was thus compelled to become aware of the presence of those objects, yet all this did not help him in the least to solve the problem. In other words, chance alone, however favorable, could not bring about a successful solution. Insight into the organization of the test-situation must be aroused before the goal could be attained.

From the point of view of time, insight could be immediate or delayed. When the subject went after the lure and secured it with such directness that no real problem existed for him, he was exhibiting immediate insight. On the other hand, when the solution came only after a period of trial and error, the subject was manifesting delayed insight. While immediate insight was invariably complete, delayed insight was of two varieties: complete and partial. The former was characterized by a "clear and convincing definiteness" of the solving response and a positive transfer of learning in later problem-situations. The latter, on the contrary, was typified by a more or less uncertain, ill-defined and tentative solving reaction on the part of the subject, and a conspicuous lack of positive transfer of learning.

Delayed insight, whether complete or partial, could mature either during the experiment or between trials. The latter occurred especially often in cases who, due to illnesses or other reasons, were compelled to be absent from the Nursery School for a few days. This would seem to indicate the presence of maturational factors in problem solving.

#### 4. *Failures and Their Causes*

While apparently no problem in the present investigation was solved without the presence of insight, insight alone did not always bring about the successful conclusion of a solving process. Evidence shows that occasionally failures occurred even where insight was present. The question is then raised as to what the underlying causes of the subject's failures were in problem-

situations. Although the number of children participating in the present study was too small to exhaust all types of such causes, the available data did reveal some very significant kinds which alone or in combination prevented the subject from bringing the solving process to a successful end.

a. *Lack of self-reliance.* At least two of the eight subjects had never learned, up to the time they became enrolled in the Nursery School, to rely on themselves for something they wanted to possess or some objective they wished to reach. They had been so accustomed to having their desires satisfied by someone else's action that when confronted with a problem in the present experiment, they simply stood helplessly in the experimental room, looking to the assistant to secure the lure for them. Negative response was typical of the behavior of those subjects.

b. *Lack of careful observation.* The lack of careful observation of the problem-situation confronting him was characteristic of several subjects who were so anxious to attain their goal that they did not look around for the "tool" objects in the field. This was largely responsible for part of the primitive reaching described above, and was one of the main underlying causes of some of the failures in the early part of the investigation. One subject especially was so intent upon securing the lure at once that upon entering the experimental room he looked neither to the left nor to the right, but went straight to a spot directly below the lure and reached for it. This failed, he stretched and strained, leaped and jumped until he was too tired to go on. All this time he never looked around once for something in the experimental room which he might use as an aid in the attainment of the goal, despite the fact that it was the third problem-situation with which he had been confronted. (In the two preceding situations the "tools" were within the subject's visual field. In this one they were outside of his field of vision.)

c. *Lack of perseverance.* At least two of the subjects in the present study became quickly discouraged when their initial attempts to secure the lure failed to bring about the desired result. They either abandoned their efforts entirely and asked to leave the experimental room, or became indulged in substitutional reactions.

d. *Fixity of solving process.* About half of the eight subjects manifested fixity of behavior pattern in their solving processes. Although they showed superior persistence in their attempts to solve the problem, they tended to follow a definite line of attack during the entire experiment. When the particular method employed did not bring about the desired end, they appeared bewildered; but they did not seem to be capable of approaching the problem from a new angle. With those subjects it was found wise to pre-

vent the experiment from lasting too long, and to allow the interval between two successive experiments to be longer than usual.

*e. Excitability.* Most of the subjects manifested some form of unpleasant emotion when they failed to secure the lure after repeated attempts. One of the subjects, however, showed such a high degree of emotional upheaval at each slight failure that the level of his achievement was noticeably lower than his mental endowment would seem to warrant. A calm and "fluid" attitude is undoubtedly essential to success in problem solving.

*f. Physiological immaturity.* Case I, the youngest child in the group, was decidedly superior mentally. She solved all the problems in Series I with little difficulty. In Series II, Situation *B*, she failed completely not because she did not realize that the wooden stick on the railings was the "tool" to be used in her reaching for the goal (all evidence pointed clearly in the opposite direction), but because her motor coördination had not become sufficiently mature to enable her to wield the stick dexterously.

*g. Mental immaturity.* On the other hand, Case VI exhibited repeatedly unequivocal evidence of physiological maturity but was obviously mentally immature. His complete failure in the present investigation was largely due to this latter factor. He seemed to be unable to comprehend what he must do in order to attain his goal.

*h. Emotional immaturity.* At the beginning of the present study three of the subjects exhibited signs of inhibition resulting from the fact that the experimental set-up represented a departure from the nursery school routine to which they had become accustomed. Although they had already become well acquainted with both the experimenter and the assistant, they were uncomfortable and apprehensive in the novel situation, and were unable to free themselves sufficiently from those emotional disturbances to attend intelligently to the problem before them. This evidence of emotional immaturity did not last beyond the first two problem-situations, however. All the three subjects were able to adapt themselves successfully, from the emotional point of view, to the subsequent experiments.

### 5. Retention and Transfer

As pointed out above, positive transfer of learning is one of convincing evidences of complete insight. Without understanding fully the solution to a problem, it is obvious that a child cannot apply the method in the solving of a new situation. In Series I, Situation *C*, for example, if the subject did not know that he must move the chair to a spot directly below the suspended toy and step on it in order to secure his lure, he could not be expected to

move the platform in the same manner in order to obtain the toy in Series II, Situation *D*. Conversely, if the subject solved the problem in Situation *D* without hesitation or trial and error, one could feel certain that he had solved the preceding problem with complete insight, and furthermore, that he had retained the experience fully and applied it intelligently in the succeeding situation.

In the present study evidence of retention and positive transfer of solving methods is abundant. In general, the retained and transferred experiences aided the subject in the attainment of goals in the succeeding experiments. Occasionally, however, they served as a temporary setback. The most conspicuous instance in this respect was in Series II, Situation *C* in which, with one exception, all the subjects used the broom as a stick (the "tool" object in Situation *B*) before they used it as a broom. Another example was found in Series II, Situation *D* in which the subjects used the shorter stick, which they had used effectively in a previous situation (Series II, Situation *B*) as their "tool." It was not until they had proved to themselves its inadequacy that they went reluctantly for the longer stick. Even in these two instances in which retention and positive transfer of learning served as a hindrance, the idea of employing something within the subject's reach as an aid in the attainment of the goal was completely retained and put into effective use.

#### 6. *Duration of Trials*

Tables 3 and 4 show the duration of initial trial and average duration of trials of each subject in each problem-situation in Series I and II respectively. At least three important facts are revealed by these tables. First, Situation *A* in both series required the least amount of time for mastery because those situations involved no problems. Second, with all the other situations, in which real problems existed, no one situation demanded the longest duration from all the subjects. The amount of time required for the solution of a given problem varied with each individual child rather than with the nature of the problem. Third, a comparison between Tables 1 and 2 on the one hand and Tables 3 and 4 on the other shows that the length of the duration required for the mastery of a given situation by a given child was more indicative of the mental, physical, and emotional state of the subject at the time of the experiment than of the difficulty of the problem or the effectiveness of its solution.

### 7. *Intervals between Trials*

For the reasons given under "General Technique," intervals between trials had not been kept absolutely constant. Alpert has clearly stated in her study on *"The Solving of Problem-Situations by Preschool Children"* that in this type of research constancy of intervals is of minor importance (1, p. 5). The results of the present investigation confirm fully Alpert's view. It would seem that the subject's emotional set just prior to the experiment, more than the lapse of time since the last trial, should be the primary factor in determining the length of interval between trials in any problem-solving experiment.

### F. SUMMARY AND CONCLUSIONS

This study investigates the solving behavior of the preschool child when confronted with problem-situations. Eight children from the Nursery School of Texas Technological College, ranging in age from 2 years 2 months to 3 years 7 months, served as subjects. The experiment consisted of two series. In Series I the subject was free to move around in the experimental room, but the goal was invariably placed beyond the subject's reaching height. In Series II the subject was placed inside of a play-pen and the goal outside, beyond the maximum reaching length of the subject. In both series, in order to attain the goal, the subject had to improvise a "tool" out of some object within his reach.

The results of the study were analyzed both qualitatively and quantitatively. From these results the following general conclusions have been reached:

1. Problem solving involves insight. Insight may be immediate or delayed. The latter may be complete or partial. It may mature during the experiment or between exposures.
2. Retention and positive transfer of the solving process seem to be indices not only of the presence of insight, but also of the degree to which it is present.
3. Children of the preschool age vary markedly in their ability to solve simple problems such as have been devised for the present study.
4. Series II experiments, in which relatively finer muscular coordination is required of the subject for the solution, are genetically more advanced forms of tests than those of Series I in which grosser motor coordination is necessary.
5. Responses to problem-situations by preschool children are conditioned both by the difficulty of the tasks and by the psychophysical traits of the subjects. The present investigation reveals at least five different kinds of

such responses: (*a*) negative response, (*b*) substitutional reaction, (*c*) primitive reaching, (*d*) trial and error, and (*e*) immediate solution.

6. An analysis of the subjects' failures in the problem-situations reveals the following underlying causes: (*a*) lack of self-reliance, (*b*) lack of careful observation, (*c*) lack of perseverance, (*d*) fixity of solving process, (*e*) excitability, (*f*) physiological immaturity, (*g*) mental immaturity, and (*h*) emotional immaturity. The list is by no means exhaustive, but it is highly suggestive. Above all, it shows clearly the very important part personality plays in problem solving.

7. Data on the duration of trials show that: (*a*) the amount of time required for the solution of a given problem varies with each individual child rather than with the nature of the problem; (*b*) the length of the duration required for the mastery of a given situation by a given child is more indicative of the mental, physical, and emotional state of the subject at the time of the experiment than of the difficulty of the problem or of the effectiveness of its solution.

8. In problem-solving experiments constancy of intervals between trials is of minor importance.

#### G. PRACTICAL APPLICATIONS

On the basis of the findings summarized in the foregoing pages the following practical applications are suggested for use in the field of preschool education:

1. The preschool child should be encouraged, as early as possible, to be self-reliant when confronted with problems arising out of daily routine. He should never be given so much assistance that he could not experience the joy of doing simple things for himself.

2. He should be taught to be calm and composed in the face of slight but challenging difficulties, because excitability is, as has been shown, an emotional state decidedly unfavorable to the arousal of insight and its consummation in a practical solution.

3. He should be trained to be a careful observer and a persistent worker. Both keen observation and good perseverance stimulate insight.

4. If a child tends toward unwarranted persistence at one aspect of the problem, he should be taught to vary his solving procedure. On the other hand, if a child tends toward too frequent variation of the solving procedure, persistence, rather than "fluidity" of reaction, should be cultivated.

5. The preschool child should be given abundant opportunities to solve simple, everyday problems which are interesting and challenging, but which

must not be so difficult as to cause inevitable failure and profound discouragement.

6. With children who become easily discouraged, problems in which at least partial success is possible early in the period of endeavor should be employed.

7. The preschool child should be provided with test-situations in which much retention and positive transfer of learning is possible, because retention and transfer not only serve as a useful check on the presence and degree of insight, but they also help to stabilize insight.

8. Above all, the preschool child should be given every opportunity to experience the supreme satisfaction of a genuine accomplishment, that affective state which in adulthood is the motivating force for creative, adventurous undertakings.

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## THE ADAPTATION OF THE PRESCHOOL CHILD TO STANDARD BASAL METABOLISM CONDITIONS\*

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### A. INTRODUCTION

The importance of basal metabolism determinations in medicine and in nutrition as a reliable index of the general physical fitness of the examinee has long been recognized. However, practically all the work, both experimental and clinical, has been done on adults, children over five years of age, and infants under two years. With the exception of the studies of Benedict and Talbot (1) and Robb (5) very little systematic research with preschool children has been published.<sup>2</sup> One of the basic reasons for this paucity of available data at the preschool level is the difficulty of adapting young children to standard basal metabolism conditions. In fact, physicians and nutritionists are so conscious of the difficulty that they prefer to wait for the children to grow older before they accept them as eligible examinees.

In view of this gap in literature on basal metabolism and, above all, because of the desirability of establishing standards for children of the preschool age, especially for those living at an altitude of over three thousand feet, the Research Staff of the Department of Foods and Nutrition, Division of Home Economics, Texas Technological College, decided to extend its basal metabolism determinations, which have hitherto been confined to college students, to include children of the College Nursery School. It then became the task of the present writer to adapt the children to standard basal

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<sup>2</sup>In their study of the basal metabolism of undernourished children Wang, Kern, Frank, and Hays (6) included one normal preschool child, a four-year-old girl, in their control group.

metabolism conditions. In the course of two separate periods of three months each, the writer succeeded in preparing 20 children for the determinations. In this report the results of only eight subjects who participated in all sections of the comprehensive research entitled "The Psychophysical Development of the Preschool Child" will be included.

### B. PURPOSE

The present investigation attempts to fulfill a twofold purpose: (a) to determine the adaptability of the preschool child to standard basal metabolism conditions; (b) to analyze the process followed by the preschool child in the adaptation.

### C. APPARATUS

The apparatus consisted of:

1. A Benedict-Roth Metabolism Apparatus,<sup>3</sup> a closed circuit type in which oxygen consumption was measured.
2. Kymograph charts prepared specially for the Apparatus.<sup>4</sup>
3. Eight rubber mouthpieces, adapted to children's size.<sup>4</sup>
4. Eight nose clips of spongy rubber and adjustable springs.<sup>4</sup>
5. A standard iron cot, complete with mattress, sheets, blanket and a pink, blue, and yellow checkerboard-designed bedspread.
6. Twelve pieces of cotton cloth, 16 by 17 inches in size, of bright colors and graphic designs which were particularly appealing to preschool children. They were used as pillow cloths.
7. A Mother Goose rhyme book,<sup>5</sup> richly illustrated.
8. Gift seals of assorted colors and designs.
9. Construction paper of assorted colors,  $4\frac{1}{2}$  by  $5\frac{3}{4}$  inches in size.

### D. PROCEDURE

The procedure used in the study was the result of the experience gained in three months of preliminary work during which 12 children from Texas Technological College Nursery School were trained to participate in basal metabolism determinations under standard conditions.

The children were divided into four groups of three each. One child from each group had been trained in the preliminary experiment to partici-

<sup>3</sup>This apparatus was manufactured by W. E. Collins, Inc., 555 Huntington Avenue, Boston, Mass.

<sup>4</sup>These articles were also manufactured by W. E. Collins, Inc.

<sup>5</sup>The book was entitled "The Real Mother Goose." It was published by Rand, McNally and Company, Chicago, Ill., in 1930.

pate in basal metabolism determinations under standard conditions, and, therefore, acted as the leader (*L*) of the group. The other two children were absolutely inexperienced subjects (*S*'s). On the first morning, at 10 o'clock, the subjects of Group I were informed by the experimenter (*E*) and her student assistant (*A*) that they were going to another building to watch their leader "making a picture with his mouth." Then they were accompanied by *E* and *A* from the Nursery School to the experimental room which was a short distance away. At the door of the experimental room they were greeted by the technical assistant (*T*).<sup>6</sup> As soon as they had entered the room and their outdoor wraps had been removed and put away, a Victrola, playing simple children's songs and melodies, was turned on for one minute, and they were invited to listen quietly to it. This served as a "cooling-off" period from the brief excursion and the general excitement over a totally strange environment.

When the music ended, *E* addressed *L*. "*So and so, show the children how you make a picture with your mouth.*" The response to this request was invariably joy and pride on the part of *L*. With *A*'s assistance *L* selected his pillow cloth—generally one which matched his clothing—climbed onto the cot, put his head on the pillow cloth, and assumed a supine position. *T* then inserted a mouthpiece in *L*'s mouth and clamped a nose clip on *L*'s nose.<sup>7</sup> This done, the kymograph of the apparatus was set in motion, and Mother Goose rhymes were read aloud by *A*. *L* remained very still on the cot for one minute, while *S*'s watched *L* and his breathing curve, which was taking shape on one of the kymograph charts, as they listened to the nursery rhymes.

At the end of the one-minute period *L* was disconnected from the apparatus, the movement of the kymograph was checked, the nose clip and the mouthpiece were removed, and *L* rose from the cot to examine his "picture." Under *A*'s supervision he selected a sheet of colored construction paper and a gift seal. He then pasted his breathing curve, which *T* had, in the meantime, cut out for him, and the gift seal on the construction paper under the envious gaze of *S*'s. The finished product was then passed around for a closer scrutiny by every one present, after which it was returned to *L* to be taken home and shown to his family. The initial experiment was thus terminated. The same procedure was carried out with Groups II, III, and IV at 10:30 on the first morning and 10:00 and 10:30 on the second morning respectively.

<sup>6</sup>Dr. Mina W. Lamb served as the technical assistant in the experiment.

<sup>7</sup>Both the mouthpiece and the nose clip were thoroughly sterilized by boiling immediately after they had been used.

During the succeeding experimental periods the same technique was employed, except that after the demonstration by the leader of each group, the untrained subjects were invited first, to feel the mouthpiece and the nose clip; second, to try them on; third, to lie down in bed; and finally to breathe into the metabolism apparatus under standard conditions. In all these successive steps of training, great care was taken never to *coerce* a child to do any of these things. If the child appeared harassed when the idea of trying any part of the apparatus was suggested to him, *E* or *A* simply said, "*We'll try some other time,*" and the invitation was automatically withdrawn.

As soon as the new subjects of a given group were able to participate fully in the experiment without their leader's demonstration, the latter was dropped from the experiment. The very morning a given child showed unmistakable signs of being able to breathe into the metabolism apparatus with rhythm and ease, the duration of the breathing was gradually increased from a few seconds to two minutes. When he could produce an even and natural two-minute breathing curve, he was ready for the final test.

The final test, which was an exact duplication of a standard basal metabolism determination, except that it took place at noon instead of early in the morning, was designed solely to give a last check on the readiness of a given subject for basal metabolism determinations under standard conditions. Besides the subject, only *E* and *T* were present. The same experimental room and the same general technique were used. However, instead of one two-minute curve, the subject made two breathing curves of six to eight minutes each with an interval of five to ten minutes during which *S* rested on the cot, listening quietly to the nursery rhymes being read to him by *E*. When *S* succeeded in passing this final test, he was deemed fully adapted to basal metabolism determinations under standard conditions.

The experiments took place every day of the week except Saturday and Sunday. Groups I and III participated on Monday, Wednesday, and Friday of the first week and on Tuesday and Thursday of the second week. Groups II and IV participated on Tuesday and Thursday of the first week and on Monday, Wednesday, and Friday of the second week.<sup>8</sup> The entire study lasted 11 weeks.

<sup>8</sup>Theoretically each subject served in the experiment five times every two weeks, and remained in the same group under the same leadership. In actual practice, however, because of frequent absences of some of the children, the membership within a given group had to be constantly shifted. In consequence, most subjects participated in the experiment three times a week, and had different leaders and associates on different days. As all the children knew one another well, this deviation in procedure apparently did not have any retarding effect on the spontaneous adaptive behavior of the subjects. On the contrary, it served to neutralize any inequality in the degree of influence of the four leaders over their followers and of the subjects of the same group over one another.

## E. SUBJECTS

The same eight Nursery School children who participated in the Problem Solving Experiment served as subjects in this study. They ranged in age from 2 years 2 months to 3 years 7 months at the beginning of the investigation. Three of them were girls; the rest boys. All of them came from professional or semi-professional homes, and were normal or supernormal in their mental and physical development.

## F. RESULTS

A total of 146 trials<sup>9</sup> were carried out with the eight subjects. Protocol records were kept for all the trials at the time of the experiment. These records included the following data: (a) case number, (b) name of subject, (c) date and time of experiment, (d) age of subject, (e) duration of trial, (f) length of interval between trials, (g) number of trials required for complete adaptation to standard basal metabolism conditions, (h) names of other children present at the same experimental sitting and (i) behavior of subject during experiment, especially in relation to metabolism apparatus and its accessories.

These data were analyzed under two main headings: namely, (a) stages of adaptation to standard basal metabolism conditions, and (b) individual differences in the adaptation.

### 1. *Stages of Adaptation to Standard Basal Metabolism Conditions*

The results of the present study showed conclusively the adaptability of the preschool child to standard basal metabolism conditions. All the eight children, including the youngest (age: 2 years 2 months to 2 years 4 months during the investigation), became thoroughly trained subjects for basal metabolism determinations to be reported by Dr. Mina W. Lamb in another section of this comprehensive research entitled "*The Psychophysical Development of the Preschool Child*." The question was then raised as to the process followed by the subjects in the adaptation. A careful analysis of the data revealed at least eight to nine stages of adaptation which each child underwent (Table 1).

In Stage I the child showed obvious, unmistakable signs of apprehension over the experimental set-up. He would hide himself in a closet in the experimental room or stand fearfully at the entrance during the demonstra-

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<sup>9</sup>A trial consisted of the exposure and response of a given subject to the experimental set-up on a given day of the experiment.

TABLE 1

		Stages of adaptation															
		Case I		Case II		Case III		Case IV		Case V		Case VI		Case VII		Case VIII	
		Age	Trials	Age	Trials	Age	Trials	Age	Trials	Age	Trials	Age	Trials	Age	Trials	Age	Trials
I	Showing obvious ap- prehension; refus- ing to be near metabolism appara- tus and its accesso- ries during <i>I's</i> dem- onstration																
II	Enjoying watching <i>I's</i> demonstration, but refusing to touch mouthpiece or nose clip	2 yrs.	1	3 yrs.	1	3 yrs.	1	3 yrs.	1	3 yrs.	1	3 yrs.	1	3 yrs.	1	3 yrs.	3
		2 mos.	2 mos.	2 mos.	7 mos.	4 mos.	3 mos.	3 mos.	4 mos.	3 mos.	3 mos.	4 mos.	6 mos.	6 mos.	3 mos.	3 mos.	
III	Feeling mouthpiece or nose clip or both, but refusing to try them on	2 yrs.	1	3 yrs.	1	3 yrs.	1	3 yrs.	1	3 yrs.	1	3 yrs.	1	3 yrs.	1	3 yrs.	3
		2 mos.	2 mos.	2 mos.	7 mos.	4 mos.	2 mos.	3 mos.	3 mos.	6 mos.	3 mos.	6 mos.	6 mos.	3 mos.	3 mos.		
IV	Trying on mouthpiece or nose clip or both	2 yrs.		3 yrs.		3 yrs.		3 yrs.		3 yrs.		3 yrs.		3 yrs.		3 yrs.	2
		2 mos.	2 mos.	2 mos.	3	4 mos.	2 mos.	2 mos.	7	4	3 yrs.	3	3 yrs.	3	3 yrs.	3	
V	Lying down in bed, with metabolism ap- paratus well be- yond normal range	2 yrs.		3 yrs.		3 yrs.		3 yrs.		3 yrs.		3 yrs.		3 yrs.		3 yrs.	1
		2 mos.	2 mos.	2 mos.	3	4 mos.	2 mos.	3 mos.	5	1	3 yrs.	2	3 yrs.	2	3 yrs.	1	
VI	Breathing into me- tabolism apparatus with nose held by <i>I</i>	2 yrs.	5	3 yrs.	5	3 yrs.	1	3 yrs.	3	3 yrs.	2	3 yrs.	4	3 yrs.	2	3 yrs.	1
		3 mos.	3 mos.	3 mos.	7 mos.	5 mos.	3 mos.	3 mos.	5 mos.	3 mos.	4 mos.	6 mos.	6 mos.	3 mos.	3 mos.	3 mos.	

TABLE 1 (continued)

		Stages of adaptation							
		Case I	Case II	Case III	Case IV	Case V	Case VI	Case VII	Case VIII
		Age	Trials	Age	Trials	Age	Trials	Age	Trials
VII	Breathing into me-								
	tabolism apparatus								
	under standard con-	2 yrs.	2	3 yrs.	1	3 yrs.	1	3 yrs.	1
VIII	ditions: duration not	3 mos.	3 mos.	8 mos.	5 mos.	3 mos.	4 mos.	3 yrs.	4 mos.
	more than one min-							7 mos.	
	ute								
IX	Breathing into me-								
	tabolism apparatus								
	under standard con-	2 yrs.	2	3 yrs.	1	3 yrs.	1	3 yrs.	1
IX	ditions: duration	3 mos.	3 mos.	8 mos.	5 mos.	3 mos.	4 mos.	3 yrs.	4 mos.
	from slightly over								
	one minute to two	2 yrs.	7	3 yrs.	4	3 yrs.	5	3 yrs.	8
IX	minutes	4 mos.	3 yrs.	8 mos.	6 mos.	3 yrs.	6 mos.	3 yrs.	5 mos.
IX	Making two breath-								
	ing curves of 6-8								
	minutes each with	2 yrs.	1	3 yrs.	1	3 yrs.	1	3 yrs.	1
IX	an interval of 5-10	4 mos.	5 mos.	8 mos.	6 mos.	4 mos.	6 mos.	8 mos.	5 mos.
	minutes under stand-								
	ard metabolism con-								
	ditions								

tion by the leader of the group, refusing flatly to come closer to the metabolism apparatus or to have anything to do with the mouthpiece or the nose clip. This initial stage in the process of adaptation to standard basal metabolism conditions was revealed in the behavior of three of the eight subjects in the present study. However, none of them remained in this stage very long.

It is the writer's conviction that had the children who participated in the research not already known the experimenter, the assistants, and one another at the beginning of the experiment, all eight of them would have revealed signs of apprehension, which was the distinguishing feature of Stage I.

In Stage II the subject became an interested observer of his leader's demonstration, and enjoyed listening to the nursery rhymes being read to the latter by the student assistant. He even watched with envy while the leader mounted his breathing curve on a piece of brightly colored construction paper and ornamented it with a gift seal of alluring design. Nevertheless, he was still somewhat wary of the experimental set-up and preferred not to have anything to do with it. Any urging by the experimenter to become acquainted with the apparatus, on this point, would undoubtedly force a timid child to retreat to the initial stage. All the eight subjects passed through this second stage of adaptation. All, except Case VIII, remained in it for only one experimental sitting.

In Stage III the subject showed willingness to *touch* the mouthpiece or the nose clip or both, but touching them was the farthest the child was ready to go. All the subjects went through this stage, and all, except Case VIII, remained in it for only one sitting.

In Stage IV, the subject, having observed his leader's demonstration two or more times, was now ready to try on the "balloon" and the "eye-glasses" (the children's terms for the mouthpiece and the nose clip respectively). At first he would allow the nose clip barely to perch on his nose and the mouthpiece to remain momentarily between his teeth. However, as he became more and more used to them, he would hold either or both in position for an increasingly longer period of time. Finally he would hold both in position simultaneously for as long as a half-minute. Liberal praises by the experimenter and her assistants for the child's success generally facilitated the latter's progress in this stage.

All the eight subjects remained in this stage for more than one sitting, one as long as seven sittings. It was one of the more difficult stages of adaptation which the children underwent.

Immediately succeeding (occasionally immediately preceding) or coincident

with Stage IV was Stage V in which the child agreed to lie supine on the experimental cot on condition that the metabolism apparatus was moved sufficiently far away to insure his immunity from its encroachment. All the subjects, except Case IV, remained in this stage for only one or two sittings before they were ready for the next stage of adaptation.

In Stage VI the subject, having now become accustomed to viewing the experimental set-up in a supine position, breathed for the first time into the metabolism apparatus while *T* held his nose.<sup>10</sup> In so doing he experienced for the first time the supreme joy of achievement, the joy of having performed a difficult task well. As one watched the child's reaction from the time he rose hurriedly from the experimental cot to examine the product of his toil, one was invariably impressed by the infinite pride with which the child mounted his first breathing curve on a sheet of colored construction paper of his own selection, and ornamented it with a gift seal chosen after much scrutiny.

The subject's breathing curve was necessarily very sketchy and uneven at first. However, it soon increased in regularity and length as the child learned to breathe through his mouth with more ease and rhythm. If and when the subject acquired those two qualities in his breathing, one might feel reasonably certain that in time he would become thoroughly adapted to standard basal metabolism conditions. Stage VI was a critical stage in this respect.

All the eight subjects passed through this stage, although the number of sittings required by each subject varied considerably.

In Stage VII the child learned to breathe into the metabolism apparatus with the nose clip clamped securely on his nose. In most instances he would protest mildly the first time the nose clip was applied, but never for long. By now he had become so accustomed to breathing through the mouth that the presence of the nose clip did not really trouble him. Furthermore, he was perfectly willing to suffer some discomfort as long as he was allowed to possess his breathing curve and take it home.

All the subjects went through this stage. However, with the exception of Case VII, none remained very long.

The transition from Stage VII to Stage VIII was an imperceptible one. The experimenter simply allowed the experiment to go beyond the one-

<sup>10</sup>Although in Stage IV the subject learned to tolerate the discomfort of having his nose clamped with a nose clip while in a standing position, he still objected to the experience while lying on the experimental cot. The two experiences were apparently similar but not identical. The latter gave an unstrained subject a feeling of suffocation much more readily than the former.

minute period as soon as the subject was sufficiently relaxed and his breathing sufficiently rhythmical to convince her that he could participate in the experiment a little longer without undue hardship.

All the subjects, with the possible exception of Case III, remained in this stage for a long time. The main reason for this seeming lack of progress was because the experimenter wished to be absolutely certain that each subject was adequately trained to meet all the requirements of the standard basal metabolism conditions before he was given the final test. The criteria for this adequacy in training were: (a) The subject must be able to produce a two-minute breathing curve of uniformity and rhythm; (b) he must be able to lie supine on the experimental cot for at least two minutes, completely relaxed and absolutely still; (c) he must be able to fulfil the first and second criteria with automatic ease. When he could meet all these three standards he was given the final test.

Stage IX represented the passing of the final test by the subject. As has been explained earlier under "Procedure," in order to pass the test, the subject had to produce, under standard basal metabolism conditions, two breathing curves of six to eight minutes each with an interval of five to ten minutes during which he was to lie quietly on the cot, listening to the nursery rhymes being read to him by the experimenter. Despite the fact that the test-requirement meant a sudden and enormous increase in the duration of the experiment, not a single subject failed to pass the test. It showed that once a child had learned to breathe evenly and rhythmically into the metabolism apparatus for two minutes, he could do so for six to eight minutes without difficulty.

## 2. *Individual Differences in the Adaptation*

Behind this general pattern of adaptation to standard basal metabolism conditions, common to all the subjects of the present study, as shown in the description of the stages of adaptation, there were significant individual differences which were revealed by the analysis of the available data. They are:

1. The number of trials required to become completely adapted to standard basal metabolism conditions varied with individual subjects (see Table 2). Although the oldest (Case III) and the youngest (Case I) subjects in the present investigation did require the lowest and the highest numbers of trials respectively of the group, the rest of the children did not conform to this trend. Rather, it seemed that the number of trials required by a given subject depended upon the combined result of a number of factors;

TABLE 2  
NUMBER OF TRIALS REQUIRED BY EACH SUBJECT FOR ADAPTATION

Case No.	Age	Number of trials
I	2 years 2 months to	23
	2 years 4 months	
II	3 years 2 months to	19
	3 years 5 months	
III	3 years 7 months to	11
	3 years 8 months	
IV	3 years 4 months to	18
	3 years 6 months	
V	3 years 2 months to	17
	3 years 4 months	
VI	3 years 3 months to	21
	3 years 6 months	
VII	3 years 6 months to	20
	3 years 8 months	
VIII	3 years 3 months to	17
	3 years 5 months	

namely, the speed and degree of his adjustment to a new environment, the potency of his curiosity about novel objects, his susceptibility to adults' praises and material rewards, his imitativeness of his contemporaries, and, above all, his motor coördination and the rapidity with which he was able to automatize a newly learned act, i.e., breathing exclusively through the mouth in a supine position.

2. Children differed markedly from one another in the initial step of their adaptation to standard basal metabolism conditions. As has been pointed out earlier in this report, three of the eight subjects showed obvious signs of apprehension at the beginning of the investigation despite the fact that they knew the experimenter, the assistants, and one another well. The remaining five children, on the other hand, showed active interest in the experiment from the very beginning. While they did not wish to have any bodily contact with the metabolism apparatus and its accessories on the first day, they asked many a question about them, and watched their leaders'

demonstrations with close attention. They were particularly delighted with the nursery rhymes being read to their leaders during the demonstration. This last fact was particularly evident in the behavior of Case VIII who was so fascinated by the rhymes from the first day on that he nestled in a chair very close to the student assistant, who did the reading, forgetting altogether his propinquity to the metabolism apparatus and the experimental cot; although his subsequent behavior record shows that his apprehension of the experimental set-up was decidedly above the average: he refused to try on the mouthpiece and the nose clip for *six* successive experimental sittings.

In this connection, it may be pointed out that those children who showed initial fear for the experimental set-up were not necessarily the ones who required the largest number of trials to become completely adapted to standard basal metabolism conditions (see Tables 1 and 2). In other words, those who had the greatest distance to travel before they arrived at the goal were not always the last ones to reach there.

3. Difficulties encountered by individual subjects in their adaptation to standard basal metabolism conditions apparently differed primarily in *quality*. With Cases I and VI the difficulties seemed to be principally motor. Case I found it very hard to breathe through the mouth even in an upright position. It took her six consecutive experimental sittings to master that art sufficiently to proceed to the next stage of adaptation. Case VI, on the other hand, found it difficult to breathe evenly and rhythmically even after he had apparently met all the other requirements of the experiment. Every now and then he would hold his breath just a little longer than usual with the result that his breathing curve appeared markedly ragged. It took him 10 consecutive sittings to overcome this difficulty sufficiently to take his final test. Even then the improvement was far from being complete. Both the experimenter and the technical assistant were finally convinced that this somewhat irregular pattern of breathing was for Case VI a normal pattern. The subject's breathing curves, produced during the subsequent basal metabolism determinations proved the correctness of this conviction.

The difficulties encountered by Cases IV and VIII, on the other hand, were mainly emotional. Case VIII, as has been mentioned earlier in another connection, had a strong abhorrence for the mouthpiece and the nose clip and was very slow in trying them on. Once he did so, the rest of the stages of adaptation presented little difficulty for him. With Case IV the primary trouble was to overcome her reluctance to lie down on the experimental cot (Stage V) and to breathe into the metabolism apparatus in the

supine position (Stage VI). Her long period of absence from the Nursery School, on account of illness, in the middle of the experimental period undoubtedly contributed to her reluctance.

The difficulties faced by Case VII seemed to be largely physiological. He showed little hesitation to participate actively in the experiment, but he was a child who found it almost impossible not to move around on the experimental cot every few seconds. He improved considerably after eight consecutive periods of training in Stage VIII, but he never became as completely relaxed and still during the experiment as Cases V and VI, for instance, and probably never will.

4. The degree and form of active participation in the experiment varied markedly with individual subjects. Case II, for example, always vied for the first turn in his participation in the experiment as soon as he became acquainted with the experimental procedure. Indeed, he was so afraid that he might be left behind that he usually announced vociferously his intention to be the first participant upon entering the experimental room. In consequence, he was trying to breathe into the metabolism apparatus long before he was sufficiently trained for it. Case I, on the other hand, was a child of few words. When she had succeeded in making initial adjustment to the experimental set-up, instead of clamoring loudly for the first turn, she simply climbed quietly onto the experimental cot while the other children were still listening to the Victrola music, thus assuring herself of the first opportunity to serve in the experiment.

Another form of active participation in the experiment was evidenced by the behavior of Case III, who was repeatedly observed to assist actively in the insertion of the mouthpiece and the clamping of the nose clip. Case V did the same at a slightly later date. A more primitive form of active participation in the experiment, common to all the subjects, was the wide opening of the mouth, as soon as they assumed the supine position, in anticipation of the insertion of the mouthpiece.

On the other extreme was Case VI who, aside from the anticipatory opening of the mouth, was never observed to vie for the first turn or to assist actively in the placement of the mouthpiece and the nose clip. He submitted himself readily to any reasonable request made by the experimenter or the assistants, but would seldom volunteer his services. Case IV was somewhat like Case VI in not asking for the first turn or assisting actively in the placement of the mouthpiece and nose clip, but was a more determined objector if she did not wish to perform something which was requested of her. Case VIII was nearly always the last to participate in the

experiment on any given day. He showed a certain amount of timidity about the apparatus which lasted till the very end of the experimental period.

### G. DISCUSSION

The results of the present study have proved conclusively the adaptability of the preschool child to standard basal metabolism conditions, thus dispelling once for all the generally accepted, but not scientifically tested, belief that it is almost impossible to adapt so young a child to such highly exacting conditions. In fact, as will be shown by a subsequent study on basal metabolism determinations, once trained, the preschool child will not only retain the learning for a long period of time; but because he naturally relaxes more easily and more completely than an average adult, he is also a better subject than the adult in basal metabolism determinations.

In adapting the preschool child to standard basal metabolism conditions, one must bear in mind a number of significant points:

First, the success of the adapting procedure depends very largely upon the selection of proper motivating factors. In order to be effective these factors must correlate *specifically* with the sensorimotor development and involuntary action tendencies of children of the preschool level (cf. 4, p. 57). The brightly colored and graphically designed pillow cloths, the variegated construction paper, the gift seals of appealing designs, and, above all, the breathing curves which the children produced themselves were examples of such motivating factors employed in the present study.

Second, in providing proper environment in which the preschool child may learn to adapt himself to standard basal metabolism conditions to the best of his ability, one must avoid over-urging at all times. It is far more important to cultivate in the child his self-confidence in a totally new situation and to bring out his natural desire to excel and to achieve by judicious use of praise, encouragement, reassurance, and constructive suggestion than to reveal anxiety over his seemingly slow progress by goading him to success. Such an act at any stage of adaptation will surely result in failure.

Third, it is a well established fact that the preschool child will imitate one of his own age much more readily than one who is many years his senior. The successful conclusion of the present study was, in a large measure, due to the utilization of this important human tendency. In an adaptation experiment of this kind, therefore, it seems that this contemporary-imitation quality of the preschool child should be utilized in full.

The predominant type of learning involved in the present study was that of association, both in the classical sense of contiguous pattern and in the

contemporary sense of conditioned reflex and trial and error. "Insight," or sudden learning in the Köhler-Gottschaldt use of the term (3, 2), played, if present at all, a very minor rôle here (cf. *The Solving of Problem-Situations by the Preschool Child* in another section of the present comprehensive research). In the process of becoming adapted to standard basal metabolism conditions the subject gradually learned to associate such initially unpleasant experiences as the insertion of the mouthpiece, the clamping of the nose clip, and the abstinence from movement while lying in a supine position on the experimental cot with such pleasant experiences as the acquisition of attractive construction paper, the interesting gift seals, and, above all, the "very wonderful" breathing curves which he made "all by himself" by means of the metabolism apparatus. Because of his eagerness to secure the pleasant experiences, he learned at first to tolerate the unpleasant experiences as necessary evils. Then as practice rendered him more and more expert in breathing exclusively through the mouth while lying in a supine position, he became increasingly unaware of their presence, until finally he even came to welcome them as a part of the pleasant whole. When the once apprehensive, negativistic child had reached this final stage, he had completed the associative learning required by the present investigation, and was therefore psychologically ready for basal metabolism determinations under standard conditions.

#### H. SUMMARY AND CONCLUSIONS

This experiment investigates the adaptability of the preschool child to standard basal metabolism conditions and the process followed by the child in the adaptation. Eight subjects, ranging in age from 2 years 2 months to 3 years 7 months, participated in the investigation. A simple adaptation technique was employed whereby the subject gradually learned to breathe rhythmically into a Benedict-Roth Metabolism Apparatus for two consecutive periods of 6-8 minutes each while lying quietly in a supine position on an experimental cot. From the results of this study, which consisted of detailed protocol data, the following general conclusions have been drawn:

1. The normal preschool child is capable of becoming adapted to standard basal metabolism conditions.
2. The normal preschool child goes through some nine different stages in the adaptation, during which he gradually learns to discard his initial negativism toward the experimental set-up and to associate all the unpleasant experiences involved in the experiment with all the pleasant into one pleasant whole.
3. In this associative learning used by the preschool child in his adaptation to standard basal metabolism conditions, the primary drive is the child's

desire for achievement. This is reinforced by his spontaneous curiosity about the novel and the colorful, his susceptibility to adults' approval and to material rewards, and his imitativeness of his contemporaries.

4. The rapidity with which the preschool child becomes completely adapted to standard basal metabolism conditions is dependent upon the strength of his primary and secondary drives and upon his native endowment, both mental and physical.

5. The success of an experiment of this type depends, in a large measure, upon the careful selection of appropriate motivating factors which must appeal powerfully to the primary and secondary drives and lie within the sensorimotor capacities of a given age level.

6. The policy of never *coercing* a child, but always securing his absolute willingness, adopted in this study, is probably another important factor responsible for the success of an experiment of this type. Without fear of compulsion the child is then free to utilize his native capacities in meeting experimental requirements.

7. Difficulties encountered by individual preschool children in their adaptation to standard basal metabolism conditions differ primarily in quality. These qualitative differences reveal plainly interesting personality, intellectual, and physical differences of the participants.

8. Children also differ in the initial step of adaptation to standard basal metabolism conditions and in the degree and form of active participation in the experiment. These individual differences reveal underlying personality, intellectual, and physical differences of the participants which are in keeping with those revealed by the qualitative differences of the difficulties encountered by the children in their adaptation.

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## THE DEVELOPMENT OF DIRECTIONALITY IN DRAWING\*

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### A. INTRODUCTORY

Gravity is one of the most ubiquitous of all stimuli which impinge upon a growing organism. All movements initiated by the organism are in a sense contests with gravity. Each movement begins somewhere and ends somewhere; it takes a direction in geometric space. *Directionality* is the tendency of a movement to pursue a characteristic course under given conditions.

So stated the phenomena of directionality are extremely pervasive and complex. They can be investigated with precision only when a host of factors are reduced to perfect control. The present study can scarcely claim such control. It deals mainly with the evidences of directionality observable in the pencil and crayon drawings of preschool and school children. Nevertheless trends of directionality clearly asserted themselves under the conditions of this study. What is the developmental import of such trends?

### B. SUBJECTS AND DATA

The basic data were assembled incidentally to developmental examinations of preschool and school children, conducted by Dr. Frances L. Ilg at the Yale Clinic of Child Development. The subjects ranged in age from 18 months to 84 months, and in intelligence from average to very superior. The examinations occurred at six-month intervals. The number of records available for each of 10 semi-annual intervals averaged 34, with occasional ranging from 8 to 68. The data favored sequential analysis because most of the subjects were examined over a four-year period. Responses of 12 adult subjects were included for comparative purposes. A preliminary exploration of these phenomena of directionality had been made in connection with a normative survey as reported in the section on Motor Development in *The First Five Years of Life* (2, pp. 98-101).

All told, 1,560 drawings were considered. Inasmuch as these drawings were made under standardized clinical conditions, they embodied a relatively high degree of control with respect to writing materials, chair, table, paper, the method of presentation, and antecedent activities. These controls

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however were applied under conditions of optimal freedom permitting spontaneous postural orientations on the part of the children. The directions of their drawing executions were promptly recorded by arrows and other conventional devices.

A fuller description of the manner in which these drawing situations were administered will be found in an earlier publication (2, pp. 158-169).

### C. THE DRAWING SITUATIONS

The drawing situations covered by this study are listed below. These drawing situations were responsive rather than spontaneous. With the exception of the vertical and horizontal strokes they were responsive to a model. Inasmuch as we were less interested in the success and failure of performance than in the development of functions,<sup>1</sup> as many tests as possible were applied at each age, not omitting very elementary tests, well below the subject's ability.

#### *Imitative Drawing*

Vertical stroke

Horizontal stroke

#### *Drawing from a Model*

Circle

Cross

Square

Triangle

Rectangle with Diagonals

Diamond

### D. ANALYSIS OF THE DATA

The drawings were individually analyzed with respect to all characters bearing on directionality characteristics such as placement, direction, length, continuity, distribution, and order of individual strokes. These characteristics are significantly related because the course of any movement is influenced by the orientations in space and time. The orientation factors increase in number with the complexity of the models copied.

The directionality trends for each situation are summarized in a synopsis. Frequencies suggestive of a trend are printed in bold face, in tables of percentages.

Reproductions of the responses most characteristic of each age level for

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<sup>1</sup>It will be noted, however, that the drawing performances corresponded closely to the normative trends outlined in the *First Five Years of Life* (2). An acceleration of approximately six months or less is suggested in the case of cross, square, and triangle.

TABLE 1a  
SUMMARY OF TABLE 1: VERTICAL LINE

<i>Placement</i>	
On model (18 months)	
Halfway across page (24, 30 months)	
Three-quarters across page (36 months)	
Extreme right of page (36, 42, 48, 54 months)	
One-quarter across page (54, 60 months)	
May be on model, one-quarter across page, three-quarters across page, or at extreme right (72 months)	
One-quarter across page (adults)	
(At 42 months only is a square drawn)	
<i>Direction</i>	
Large majorities at all ages draw the line downward.	
<i>Length</i>	
Half length of model (18 months)	
Three-quarters length of model (24 months)	
Full length (30 through 72 months and in adult)	

TABLE 1  
PERCENTAGES

Age in mos.	No. of cases	Draws on model	Placement of line			extreme right	Squared or otherwise
			$\frac{1}{4}$ across page	$\frac{1}{2}$ across page	$\frac{3}{4}$ across page		
18	8	62%	0%	38%	0%	0%	0%
24	32	25	9	48	18	0	0
30	55	15	12	46	18	7	2
36	68	7	16	10	30	30	7
42	54	3	16	14	11	32	24
48	42	4	10	14	14	48	10
54	5	0	40	0	0	40	20
60	2	0	100	0	0	0	0
72	4	25	25	0	25	25	0
Adult	12	0	100	0	0	0	0

Age in mos.	Length of line*			
	Quarter length	Half length	Three-quarter length	Full length
18	0	50	37	12
24	0	25	68	6
30	2	9	30	58
36	0	2	19	79
42	0	2	16	80
48	0	0	20	80
54	0	0	0	100
60	0	0	0	100
72	0	0	0	100
Adult	0	0	0	100

\*No table is given for *direction of line* since more than 95 per cent draw downward at all ages except at 18 and 24 months when 13 per cent and 10 respectively draw upward.

TABLE 2a  
SUMMARY OF TABLE 2: HORIZONTAL LINE

<i>Placement</i>	
Halfway down page (18 months)	
On model or three-quarters down page (24, 30 months)	
Three-quarters down page (36 months)	
Extreme bottom or squared (42, 48 months)	
Squared (54 months)	
One-quarter down page (60, 72 months, adult)	
<i>Direction</i>	
Large majority at all ages draw line to the right.	
<i>Length</i>	
Half length of model (18 to 24 months)	
Three-quarters length of model (30 months)	
Full length (36 through 72 months and in adults)	
<i>Comments</i>	
Note that this is the same trend, both as to placement on page and length of line that is seen with the vertical stroke, but behaviors occur six months later with the horizontal stroke than with the vertical.	
In about two-thirds of individual cases at each age, vertical and horizontal strokes are in the same relative position on the page. In about one-third at each age the vertical line moves over before the horizontal line moves down.	

TABLE 2  
PERCENTAGES

Age in mos.	No. of cases	Draws on model	Placement of line			extreme bottom	Squared or otherwise
			$\frac{1}{4}$ down page	$\frac{1}{2}$ down page	$\frac{3}{4}$ down page		
18	5	0%	0%	60%	40%	0%	0%
24	23	30	13	13	40	4	0
30	52	27	15	15	23	18	2
36	63	8	14	6	26	24	22
42	52	8	10	8	8	30	36
48	41	2	12	8	17	36	25
54	6	0	17	17	0	17	50
60	2	0	100	0	0	0	0
72	3	0	66	0	0	33	0
Adult	12	0	100	0	0	0	0

Age in mos.	Length of line*			
	Quarter length	Half length	Three-quarter length	Full length
18	20	40	20	20
24	8	70	22	0
30	8	26	50	16
36	0	12	38	50
42	0	0	29	71
48	0	2	25	73
54	0	0	33	66
60	0	0	50	50
72	0	0	0	100
Adult	0	0	0	100

\*No table is given for *direction of line* since 95 per cent or over draw toward the right at all ages except at 18 and 30 months when 20 per cent and 6 per cent respectively draw to the left.

TABLE 3a  
SUMMARY OF TABLE 3: CIRCLE

<i>Direction</i>	
Counterclockwise (30, 36 months)	
Clockwise (42 months)	
Clockwise or counterclockwise (48 months)	
Clockwise (54, 66 months)	
Counterclockwise (72, 84 months and adults)	
<i>Starting point</i>	
Top (30, 36 months)	
Bottom (42 months)	
Top (48, 54 months)	
Top or bottom (60 months)	
Top (66 through 84 months and adults)	
<i>Extent</i>	
Round and round (30 months)	
Circle just overlaps (36 months)	
Lines meet without overlap (42 through 84 months and adults)	
(May just fail to meet, a few cases—36-42 months)	
<i>Comment</i>	
Note that the change of starting point, from top to bottom, at 42 months coincides with the age when the direction of drawing is reversed from counterclockwise to clockwise.	

TABLE 3  
PERCENTAGES

Age in mos.	No. of cases	Direction of drawing		Place of starting			
		Clockwise	Counter- clockwise	Top	Bottom	Left	Right
30	17	30%	70%	58%	11%	18%	11%
36	36	33	66	36	33	9	11
42	52	71	29	26	43	17	2
48	48	50	50	45	22	12	10
54	21	76	24	52	4	28	0
60	27	55	45	29	22	29	14
66	17	64	36	54	41	5	0
72	27	41	59	59	29	11	0
84	16	19	81	62	12	18	6
Adults	12	0	100	85	0	15	0

TABLE 4a  
SUMMARY OF TABLE 4: COPY CROSS

*General trend*

The trend is from two parallel lines, either horizontal or vertical though mostly vertical (46 per cent in all) at 30 months; to an actual two-part cross, without splitting of either line. By 36 months and after—except at 42 months—most make an actual cross. Two parallel lines do not occur appreciably after 30 months.

30 months: Two parallel lines.

36-48 months: An actual cross. Vertical line down, then horizontal line to the right. There may be a horizontal split.

54 months: An actual cross. Vertical line down then horizontal line to the right; or vertical line down, then horizontal line to the left.

60-84 months: An actual cross. Vertical line down, horizontal line to the right.

*Splitting of lines*

Splitting of lines occurs as follows. *Vertical splitting* is rare, though it occurs before the horizontal split, i.e. at 30 months. It occurs most at 42 months when it reaches the large proportion of 20 per cent. An *horizontal split* occurs chiefly from 36 months through 48 months, i.e.: 16 per cent at 36 months; 33 per cent at 42 months; 34 per cent at 48 months. A *split both ways* occurs most at 42 months, i.e. 11 per cent.

*Direction of lines—Order of drawing*

The majority at all ages draw the vertical line down first; then the horizontal line to the right. Vertical line down, horizontal line to the left is prominent only at 54 months when it equals vertical line down, horizontal line to the right (30 per cent each). Horizontal line first does not occur frequently. It occurs most at 54 months (25 per cent).

*Place of crossing*

The place of crossing migrates somewhat as shown by the table.

*On the vertical line*, the crossing appears first toward the bottom (30 months); then too far toward the top (36, 42 months); then half way (48 through 72 months). It then moves up toward the top again (84 months); and by adulthood returns to half way.

*On the horizontal line*, it starts toward the right or left (30 months); moves too far left (36, 42, 48 months), then is about halfway from then on (54 months ff.). Note that accurate vertical (up and down) placement of the horizontal line on the vertical comes earlier than the placement of the vertical line on the horizontal, but varies a little more after having once become accurate. It is about 54 months before the cross becomes accurate as to place of crossing; and at 84 months the horizontal line is too high on the vertical.

TABLE 4  
PERCENTAGES

Age in mos.	No. of cases	Placement and continuity of lines				
		Two paral- lel lines	Vertical split	Horizontal split	Two-way split	A good cross
30.	13	46%	15%	0%	0%	38%
36	36	5	8	16	5	69
42	44	2	20	33	11	43
48	50	0	10	34	6	62
54	20	0	10	10	5	85
60	28	0	0	10	0	78
66	18	0	0	5	0	94
72	20	0	0	10	0	90
84	17	0	0	11	0	88
Adult	12	0	0	0	0	100

Age in mos.	Direction and order of lines				
	Vertical down horizontal to right	Vertical down, horizontal to left	Vertical up, horizontal either way	Horizontal to right, vertical down	Horizontal to right, vertical up
30	15	7	0	7	7
36	32	13	5	5	11
42	29	2	5	3	0
48	38	8	6	8	2
54	38	30	0	20	5
60	50	14	3	10	0
66	61	33	0	0	0
72	65	25	0	0	0
84	76	11	0	0	0
Adult	91	9	0	0	0

Age in mos.	Place of crossing*					
	Place on vertical line			Place on horizontal line		
	Toward bottom	Halfway	Toward top	Toward right	Halfway	Toward left
30	30	7	7	23	0	23
36	16	33	38	19	30	36
42	10	27	31	20	22	25
48	4	48	26	14	28	34
54	15	70	15	10	45	40
60	3	60	37	14	67	17
66	16	50	33	11	55	33
72	5	55	40	20	60	20
84	0	41	58	17	47	36
Adult	0	83	17	8	75	17

\*Recordless.

\*Regardless of direction. Those which split not included.

TABLE 5a  
SUMMARY OF TABLE 5: COPY SQUARE

*Leading patterns*

The trend here is clear. (See table immediately following for key illustrations to the directionality of designs, which are also pictured in Figure 2.)

36-42 months: Design 1, four separate lines.

48 months: Design 1 or Design 2, four separate lines.

54-60 months: Design 3, four separate lines.

66 months: Design 3 or Design 4, one line.

72-84 months: Design 3, one line.

Adult: Varied. Mostly Design 2, 3 or 4. One, two or three lines.

*Meeting of lines, and corners*

At first both lines cross at each corner. The trend is toward one continuous line, with square corners.

36 months: Both lines, or one line only, overlap at each corner.

42 months: Lines beginning just to meet without overlap (25 per cent), or corner may be rounded.

48 months: One line overlaps at each corner, lines just meet, or corner may be rounded.

54 months: Lines just meet (40 per cent) and corners are now beginning to be definitely squared (60 per cent).

60 months ff: Same, but lines just meet and corners are squared, with increasing percentages.

*Number of lines*

36-60 months: Four separate lines.

66-84 months: One line.

Adult: Great variation. Usually one, two or three lines.

TABLE 5  
PERCENTAGES





Pattern	Key No.	Age No. cases	Leading patterns								Adult
			36 mos.	42 mos.	48 mos.	54 mos.	60 mos.	66 mos.	72 mos.	84 mos.	
			10	24	34	20	30	16	24	16	12
 1	1		10%	8%	11%	0	10%	0	0	0	8%
 2	2		0	0	11	10	13	12	4	5	25
 3	3		0	4	3	25	23	50	15	37	25
 4	4		0	0	3	15	6	31	4	18	16
<b>6</b>											
			Direction of lines								
Both <i>V</i> lines down			60	44	69	50	60	43	50	37	66
+ both <i>H</i> lines to rt.			30	20	45	25	23	6	16	6	41
+ one each way			10	16	12	15	23	37	30	25	25
+ both <i>H</i> lines to left			20	8	12	10	14	0	4	6	0
Both <i>V</i> lines up			10	12	12	5	6	0	0	0	0
+ both <i>H</i> lines to rt.			10	8	3	5	3	0	0	0	0
+ one each way			0	4	6	0	0	0	0	0	0
+ both <i>H</i> lines to left			0	0	3	0	3	0	0	0	0
One <i>V</i> line each way			30	44	21	45	33	56	50	63	33
+ both <i>H</i> lines to rt.			0	12	6	10	3	0	0	0	8
+ one each way			10	32	0	30	30	56	50	63	0
+ both <i>H</i> lines to left			20	0	15	5	5	0	0	0	25
<b>Number of lines</b>											
Four lines			70	62	76	60	42	0	4	10	25
Three lines			30	30	18	20	23	20	34	10	25
Two lines			0	4	6	10	14	30	24	20	25
One line			0	4	0	10	21	50	38	60	25

TABLE 6a  
SUMMARY OF TABLE 6: TRIANGLE

*Leading patterns*

The trend here is slightly obscure but appears to be as follows. (See table immediately following for key illustrations to directionality of designs, which are also pictured in Figure 2.)

42 months: Either Design 1 or Design 2, mostly three separate lines.

48 months: Design 1, mostly three separate lines.

54-60 months: Design 3, still three separate lines.

66 months: Either Design 2, Design 3 or Design 6, two or three lines.

72-84 months: Either Design 2 or Design 3, one or two lines.

Adult: Design 6, three separate lines.

*Trend of development*

Development with respect to drawing of triangle does not take place in a straight-line manner, that is with a gradual increase of percentages for some particular design or designs. On the contrary, certain designs predominate at one age, drop out, and then come in again. Thus:

The simplest form, Design 1, is predominant at 42 and 48 months.

The second form, Design 2, predominates at 42 and again at 66 months.

The third form, Design 3, predominates at 54 through 84 months.

The sixth form, Design 6, occurs prominently at 66 months and again in the adult.

TABLE 6  
PERCENTAGES







			Leading patterns							
			42	48	54	60	66	72	84	
			mos.	mos.	mos.	mos.	mos.	mos.	mos.	Adult
Pattern	Key No.	No. cases	5	14	14	22	15	25	16	12
	1		40%	35%	0	9%	13%	0	6%	0
	2		40	7	14	4	20	20	25	0
	3		20	14	21	31	20	36	31	0
	4		0	0	0	4	6	4	0	0
	5		0	14	14	0	0	0	12	8
	6		0	14	0	9	26	12	6	75
Direction of lines										
Both sidelines down										
+ base to right			40	50	0	22	40	12	12	83
+ base to left			20	14	35	36	26	36	25	0
Both sidelines up										
+ base to right			0	14	21	13	6	4	0	0
+ base to left			0	0	0	4	0	4	0	0
One sideline up; one down										
+ base to right			0	7	28	13	6	20	31	17
+ base to left			40	14	14	8	20	16	31	0
Number of lines										
Three lines			40	57	57	50	46	28	14	75
Two lines			40	35	43	36	46	28	43	17
One line			20	7	0	14	7	44	43	8

TABLE 7a  
SUMMARY OF TABLE 7: RECTANGLE WITH DIAGONALS

*Total pattern*

Though there is marked variety from case to case, Figure 2 presents such trends as can be determined. They are as follows:

48 months: One vertical line down through center of rectangle. Many short horizontal lines out to each side.

54 months: One vertical line down through the center, four diagonal lines radiating to corners from near center of vertical line.

60 months: Large filled-in circle in center of rectangle with many spokes radiating outward to corners and sides.

66-84 months: Approximately accurate reproduction. A cross, and two continuous diagonals. Diagonals meet, however, just off center.

Adult: Accurate reproduction of model.

*Pattern of center marks only*

Very little uniformity as to order and direction even when considering center marks only. Figure 2 indicates the outstanding patterns at 66 months, 72 months, and in adults, the only ages at which there is any centralized tendency. Even here the percentages are very small. The design pictured as somewhat characteristic of 66 months occurs in only 12 per cent of the cases; the 72 months design in 12 per cent; the adult design in 25 per cent. All values are so extremely low that no table is given.

*Comparison of the rectangle with drawing of a simple square*

This comparison indicates that not until 7 years do as many as half the children draw a square figure in a standard manner regardless of the complexity of the situation. Up till that time it appears that a square drawn as part of a more complex situation (as rectangle with diagonals) is always of a less mature kind than the simple square, or of approximately the same degree of maturity, but never more mature.

TABLE 7  
Percentages

Description of design	Age No. of cases	Pattern						Adult
		48 mos. 14	54 mos. 14	60 mos. 34	66 mos. 16	72 mos. 32	84 mos. 23	
One <i>V</i> line down through center of rectangle. Many short <i>H</i> lines out to each side		21%	7%	6%	0	0	0	0
One vertical line down through center, four or more diagonal lines radiating to corners from near center of vertical line		0	21	12	12	21	26	0
Large filled-in circle in center of rectangle with many spokes radiating outward to corners and sides		14	7	18	0	0	0	0
<i>H</i> and <i>V</i> lines forming a cross in center of rectangle. Four short diagonals radiating outward to corners		14	0	6	18	15	13	0
Nearly accurate reproduction. A cross and two continuous diagonals, which meet just off center		7	21	21	43	36	47	0
Accurate reproduction		0	0	3	28	18	13	100

TABLE 8a  
SUMMARY OF TABLE 8: DIAMOND

*Direction of lines*

Great variety at all ages, even among adults. However there is some uniformity. *All four lines down* predominates at all ages except 84 months when all point down but the top left. All four lines up is practically never seen. The two right lines up, the two left down is common at several ages; as is the two right lines down, the two left up, which is especially noted at 66 months.

*Pattern*

Only at three ages is there an appreciable percentage of cases performing in any one manner. (See Figure 2.)  
Top left down, top right down, bottom left down, bottom right down—38 per cent at 66 months; 41 per cent in adults.  
Top left up, top right down, bottom right down, bottom left down—33 per cent at 84 months.

*Comment*

Note similarity of pattern at 84 months to adult square and triangle.

TABLE 8  
SUMMARY

Description of diamond	Age No. of cases	Direction of lines					
		54 mos. 3	60 mos. 14	66 mos. 13	72 mos. 33	84 mos. 12	Adults 12
All 4 downward		66%	29%	61%	55%	25%	83%
All 4 upward		0	0	0	3	0	0
Two right down; two left up		33	14	23	12	16	0
All down but top left		0	29	8	9	34	0
Two right up; two left down		0	29	8	12	25	17
Top left and bottom right up; other two down		0	0	0	9	0	0

TABLE 9a  
SUMMARY OF TABLE 9: CORRELATION BETWEEN HANDEDNESS AND DIRECTION OF DRAWING

No clear-cut consistent relationship could be found to exist between handedness of the subject and the directionality of drawing. Directionality appeared to be determined more by the age of the subject than by his handedness. Some subjects who were right-handed as well as some who were left occasionally drew in a direction opposite to the prevailing one, whereas many left-handed subjects drew in the direction customarily taken by right-handed subjects. In general, lines were as frequently drawn in a direction contrary to the prevailing one by right-handed as by left-handed subjects.

To a very small extent, left-handedness did appear to influence the direction of drawing in vertical and horizontal lines and cross, as indicated by the following table. Drawing of circle seems also to have been influenced slightly by handedness in that of five definitely left-handed children, three drew in a direction counter to the prevailing one at least one age.

TABLE 9  
SUMMARY

Figure	Total number of drawings	Direction of drawing and handedness	
		Number drawn contrary to usual direction by Right-handed	Left-handed
Vertical line	275	5	2
Horizontal line	246	3	6
Cross			
Vertical line	225	17	2
Horizontal line	225	25	11

each of the drawing situations are presented in Figures 1 and 2. In the imitative drawing situations (vertical and horizontal strokes) the heavy black strokes represent the examiner's drawing, the thinner black lines the child's performance. For the other situations, the drawings reproduced are the children's only.

### E. SUMMARY AND COMMENT

In the responsive drawing of simple forms such as vertical and horizontal strokes, circle, cross, square, triangle, rectangle with diagonals and diamond, marked developmental changes appear in the direction, order, and orientation of lines drawn. The vertical and horizontal lines were demonstrated. Sheer imitation may have influenced the direction of the responsive strokes. The placement of the lines on the paper, however, can scarcely be ascribed to such imitation factors. Likewise other directionality trends suggest neuromotor predispositions determined by the maturity of the child.

In brief summary, the outstanding developmental changes which occur in the drawing of these forms are as follows:

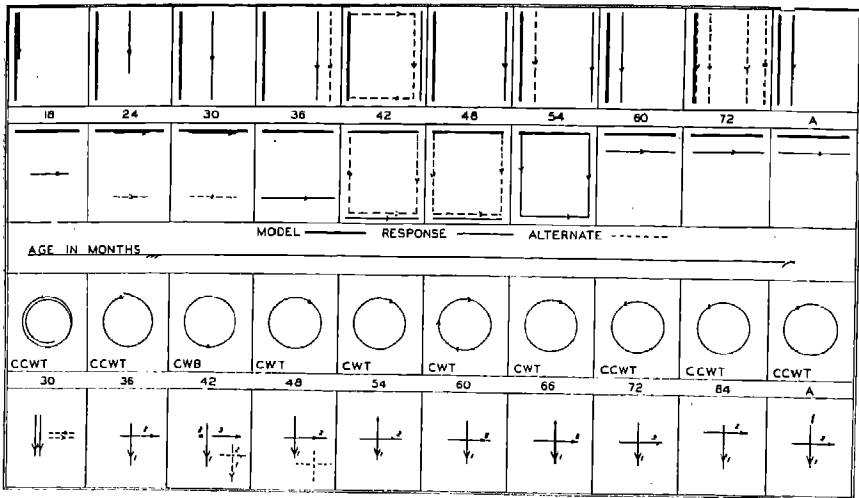


FIGURE 1.

Developmental sequences in responsive drawings of vertical and horizontal lines, circle, and cross. The predominant response for each age level from 18 months through 72 months and in adults is pictured. Possible alternative responses are indicated by dotted lines. Arrows indicate direction of drawing. For the circle they also indicate place of starting. Numerals indicate order of markings.

*Vertical line:* Moves gradually from directly on the model, across the paper to the right and then back to near the left-hand margin. The line gradually lengthens.

*Horizontal line:* Moves gradually down the page, finally returning to one-fourth down from the top. It gradually lengthens.

*Circle:* Is first copied counterclockwise, then clockwise and then again counterclockwise. At the earliest ages drawing starts at the top of the circle, then later at the bottom, then still later again at the top.

*Cross:* The trend is from two parallel lines to an actual cross. At all ages the order of drawing is primarily vertical line downward, then horizontal line from left to right. The place of intersection migrates up and down the vertical line; from too far right to too far left to near center on the horizontal line.

*Square:* The trend is from four separate lines which overlap at the corners to a one-line figure with square corners. The order of drawing the four sides varies considerably, but at 54 months and after many draw the continuous line starting by drawing the left side downward and continuing counterclockwise.

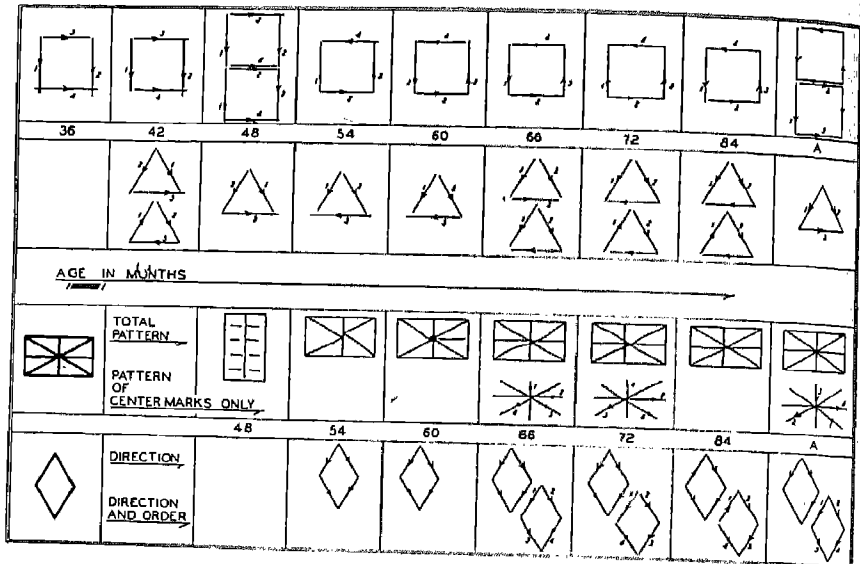


FIGURE 2

Developmental sequences in responsive drawings of square, triangle, rectangle with diagonals, and diamond. The predominant response for each age level from 36 through 84 months and in adults is pictured. Arrows indicate direction; numbers, order of drawing.

**Triangle:** Responses to this form are very varied within each age level. In general the trend is from three separate lines to one or two lines only (three lines again in the adult). The actual pattern of drawing varies markedly, with no definite direct age trend. One design predominates at one age, then drops out and then reappears. The predominant mature response appears to be left side down, then right side down, then bottom drawn toward the left.

**Rectangle with diagonals:** There is very marked variety from child to child in copying this design. Almost no two reproduce the entire figure in an identical manner as to both order and design of drawing. In general appearance the response follows a developmental sequence as indicated in the illustration.

**Diamond:** Great variability as to actual pattern. In general, all four lines are drawn downward.

Eighty-four months marks the culmination of a trend toward drawing square, triangle, and diamond with a single continuous stroke. Adults sometimes draw in the same manner but even more characteristically they

adopt the installment method of drawing by single strokes in a characteristic order. Directionality phenomena are influenced by the complexity of the model. The execution of a simple design in a complex model may be less mature than the execution of the same design in isolated simplicity.

No consistent relationship was established between handedness and directionality. In general, exceptions to the prevailing trend were as frequent in right-handed as in left-handed subjects. However, the single horizontal line and the horizontal stroke of the cross are prevailingly drawn from right to left by left handed children. This is the opposite of the trend for right handed children.

Studies of the development of prehension, manipulation, and locomotion have shown that the patterns and directions of movement are determined by current postural sets and predispositions. The normal infant at one age has a strong propensity to brandish his arm in a vertical sector. This is expressed in banging. Somewhat later he may show a similar propensity to brush his arm back and forth laterally. This represents a shift of emphasis to the horizontal axis. Pencil and crayon behavior at more advanced age levels automatically records similar changing propensities with respect to the directions of movement. In spite of innumerable environmental fortuities, such postural propensities are powerful enough to assert themselves in the tables of frequencies.

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THE SOCIAL DISTANCE BETWEEN CERTAIN RACIAL,  
NATIONALITY, AND SKIN-PIGMENTATION GROUPS  
IN SELECTED POPULATIONS OF AMERICAN  
SCHOOL CHILDREN\*

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A. PROBLEM AND METHOD

The purpose of the present investigation is to sketch the development in selected populations of American school children of certain race, nationality, and skin-pigmentation preferences. Since, moreover, we assume the patterns of change with age in the inter-group relationships are functions of many variables, we hope we may be able to label at least a few of the latter.

The procedures we used in gathering our data having been described in detail elsewhere (9), we shall mention them only briefly here. The subjects of our study were the children in one class room at each of the second-, fourth-, sixth, and eighth-grade levels in each of three mixed white and negro grade schools as well as in an all-negro one, and the white and negro pupils in two classes (tenth and twelfth grades) in a high school located in a suburb which is predominantly middle-class. We had hoped to find a high school which served a population similar to that served by the grade schools but we were not able to obtain the coöperation of such an institution. The grade schools were all located in depressed areas. In one of our mixed white and negro elementary schools the negroes held a large majority; in another, a small majority; and in still another, as well as in the high school, a small minority (Table 1).

We also studied the children in one class each of second-, fourth-, sixth-, and eighth-graders in an all-white school located in a neighborhood in which

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<sup>1</sup>From the University of Chicago. Grateful acknowledgment is hereby made of the assistance in the present study of the personnel of Works Project Administration O. P. 665-54-3-387. We wish also to express our appreciation of the services of Betty Lee Halstead, who directed much of the statistical work involved in the investigation, and of the coöperation of Supt. William H. Johnson; Ass't Supt. Miss Minnie E. Fallon; Dr. Grace Munson, Director Bureau of Child Study; and Miss Angela Cykowski, District Superintendent—all of Chicago; of Supt. H. L. Richards, Blue Island, Ill.; and of the principals of all the schools in which the children we studied were enrolled—Miss Mildred M. Duggan, Mrs. Lois Morstrom, Mr. C. M. Cummins, Mr. W. P. Hearne, and Mr. L. B. Stinnett.

TABLE 1  
NUMBER AND PERCENTAGE OF SUBJECTS IN VARIOUS SEX, NATIONALITY, AND RACE GROUPS

Sub-groups		Number of subjects		Percentage of total grade-group in sub-group					
		White males	Negro females	White males	Negro females	White females	Negro females	Total whites	Total negroes
School I, Grade 2		20	21		49		51	0	100
" " 4		17	25		40		60	0	100
" " 6		14	26		35		65	0	100
" " 8		14	22		39		61	0	100
School II, Grade 2		6	15	15	41	7	37	22	78
" " 4		4	17	11	49	9	31	20	80
" " 6		2	15	1	16	6	47	9	91
" " 8		5	14	2	16	14	38	5	43
School III, Grade 2		7	19	5	53	14	14	33	67
" " 4		6	15	6	9	17	25	34	66
" " 6		4	13	7	16	10	33	17	40
" " 8		10	13	6	10	26	33	15	26
School IV, Grade 2		12	6	13	4	34	17	37	12
" " 4		12	7	15	6	30	17	38	15
" " 6		18	4	10	5	49	11	27	13
" " 8		17	1	21	2	42	2	51	5
School V, Grade 2		13	1	12	3	45	4	41	10
Test I, Grade 10		11	1	12	2	42	4	46	8
Test I, Grade 12		19	1	9	3	60	3	28	9
Test II, Grade 12		17	1	9	3	57	3	30	10
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28
Test I, Grade 8		12	3	10	10	34	8	29	29
Test II, Grade 8		14	8	16	5	32	19	37	12
Test I, Grade 8		14	8	15	5	33	19	36	12
School VI, Grade 2		7	12	8	12	18	31	20	31
Test I, Grade 2		7	12	8	12	18	31	20	31
Test II, Grade 4		11	8	13	9	27	19	32	22
Test I, Grade 6		10	8	13	9	25	20	33	22
Test II, Grade 6		13	3	10	10	36	8	28	28

TABLE 2  
MEAN AGE IN YEARS OF EACH SEX- AND RACE-GROUP IN EACH GRADE IN EACH SCHOOL

Group				White males	Negro males	White females	Negro females	Total
School	I,	Grade	2		7.9		8.1	8.0
"	"	"	4		10.4		10.1	10.2
"	"	"	6		11.6		11.2	11.3
"	"	"	8		13.8		13.9	13.9
School	II,	Grade	2	7.8	8.4	7.6	7.7	8.0
"	"	"	4	10.0	10.4	10.4	9.9	10.2
"	"	"	6	13.5	13.2	12.5	12.6	12.9
"	"	"	8	14.5	14.4	14.0	14.1	14.2
School	III,	Grade	2	7.9	7.7	7.8	7.6	7.8
"	"	"	4	10.7	10.6	9.8	10.4	10.4
"	"	"	6	12.1	12.5	11.7	12.7	12.4
"	"	"	8	14.4	15.2	14.4	14.6	14.7
School	IV,	Grade	2	7.7	7.8	7.5	8.0	7.7
"	"	"	4	9.7	10.4	10.1	10.0	10.0
"	"	"	6	12.2	13.0	12.1	12.8	12.3
"	"	"	8	13.5	14.7	13.6	15.0	13.6
School	V,	Grade	10	15.7	15.9	15.5	15.9	15.7
"	"	"	12	18.0	17.1	17.6	18.2	17.9
				Male non- Italians	Male Italians	Female non- Italians	Female Italians	Total
School	VI,	Grade	2	7.9	7.9	7.6	7.9	7.8
"	"	"	4	9.8	10.1	9.6	10.0	9.8
"	"	"	6	12.3	13.1	11.6	11.8	12.0
"	"	"	8	13.5	13.9	13.5	13.6	13.6

an Italian-non-Italian schism was said to exist. The children of Italian extraction composed 31 to 62 per cent of the class populations investigated, but only in the second grade were they a majority.

Each child was asked to express his preference in the case of every pair of classmates in his room. This is the method of paired comparisons. Should there be 40 pupils in a class, for example, each subject would then give 740 preference judgments. This number is 40 less than the expected 780 because no choices were made in the case of those pairs in which the subject himself occurred.

Each second- and fourth-grader was interviewed singly in several short sessions by a woman who had either taught or had had considerable experience in dealing with children. The interviewers, who were carefully trained and supervised, numbered 10.

The children in the sixth grade and above were given mimeographed lists of the pairs of names between which choices were to be made and were

TABLE 3

## MEAN PREFERENCE-PERCENTAGE SCORES OF VARIOUS GROUPS OF JUDGES IN THE CASE OF VARIOUS RACIAL GROUPS

Judges Group judged	White males				White females				Negro males				Negro females			
	Males		Females		Males		Females		Males		Females		Males		Females	
	Whites	Ne- groes	Whites	Ne- groes	Whites	Ne- groes	Whites	Ne- groes	Whites	Ne- groes	Whites	Ne- groes	Whites	Ne- groes	Whites	Ne- groes
School II, Grade 2	.727	.273	.681	.319	.837	.163	.644	.356	.525	.475	.544	.456	.618	.382	.544	.456
" " 4	.696	.304	.697	.303	.627	.373	.636	.364	.508	.492	.492	.508	.524	.476	.558	.442
" " 6	.900	.100	.719	.281	.567	.433			.400	.600	.613	.387	.350	.650	.721	.279
" " 8	.761	.239	.794	.206	.843	.157	.969	.031	.257	.743	.395	.605	.379	.621	.371	.629
School III, Grade 2	.536	.464	.497	.503	.629	.371	.580	.420	.460	.540	.425	.575	.451	.549	.410	.590
" " 4	.604	.396	.614	.386	.707	.293	.700	.300	.448	.552	.511	.489	.469	.531	.454	.546
" " 6	.551	.449	.654	.346	.657	.343	.747	.253	.407	.593	.413	.587	.468	.532	.438	.562
" " 8	.656	.344	.725	.275	.710	.290	.810	.190	.231	.769	.410	.590	.235	.765	.220	.780
School IV, Grade 2	.629	.371	.732	.268	.694	.306	.710	.290	.464	.536	.612	.388	.611	.389	.667	.333
" " 4	.633	.367	.672	.328	.629	.371	.671	.329	.337	.663	.513	.487	.599	.601	.427	.573
" " 6	.729	.271	.798	.202	.919	.081	.878	.122	.088	.912	.545	.455	.511	.489	.530	.470
" " 8	.761	.239	.786	.214	.885	.115	.659	.341			.476	.524	.500	.500	.048	.952
School V, Test I, Grade 10	.897	.103	.948	.052	.962	.038	.936	.064			.069	.931	.097	.903	.014	.986
Test I, Grade 12	.831	.169	.902	.098	.930	.070	.928	.072			.056	.944	.064	.936	.166	.814

TABLE 4  
NUMBER OF JUDGMENTS MADE BY VARIOUS GROUPS OF JUDGES IN THE CASE OF VARIOUS  
NEGRO-WHITE COMPARISONS

Judges Group judged				White males		White females		Negro males		Negro females	
				Males	Fe- males	Males	Fe- males	Males	Fe- males	Males	Fe- males
School	II,	Grade	2	510	270	306	90	1,632	765	1,530	630
"	"	"	4	204	132	204	66	1,088	561	748	330
"	"	"	6	30	32	30	0	420	240	480	240
"	"	"	8	280	160	140	32	910	448	1,120	480
School	III,	Grade	2	798	175	665	100	2,394	475	665	100
"	"	"	4	450	324	540	270	1,260	810	810	432
"	"	"	6	156	448	364	672	624	1,456	832	1,680
"	"	"	8	1,170	600	780	300	1,560	780	1,300	540
School	IV,	Grade	2	792	624	936	624	360	312	288	156
"	"	"	4	924	1,080	1,260	1,260	504	630	504	450
"	"	"	6	1,224	900	720	450	216	200	360	200
"	"	"	8	272	714	357	840	0	42	34	42
School V,											
Test	I,	Grade	10	156	468	156	396	0	36	39	72
Test	II,	Grade	10	110	264	132	264	0	24	22	24
Test	I,	Grade	12	342	513	171	216	0	27	57	54
Test	II,	Grade	12	272	459	153	216	0	27	51	54

instructed to underline the name of the classmate in each pair who was preferred. These judgments were given in a group-test situation after we had tried to gain the coöperation of the children.<sup>2</sup> No pupil was asked to give the basis of his preferences, but spontaneous comments by the younger children to the interviewers were recorded. We did not want to question the children directly regarding their feelings about race, nationality or skin color, because we thought such queries would bring forth usually the response the child thought was expected. Besides, we had doubts as to the ability of at least our younger subjects to tell accurately why they preferred one child to another. We suspected, moreover, that children in the early school years might not have what might be called a generalized attitude relative to a given race but rather positive and negative valences of various strengths, and for various reasons, with respect to specific members of the race. We believe, for example, the conditionings to the details of behavior, dress, etc., sanctioned or disapproved by the racial-cultural groups of which the children were members, to be important determinants of the affect the children had relative to any classmate. We considered using an association count to discover the feelings of the pupils toward each other, but convinced ourselves

<sup>2</sup>See Reference 9 for our introductory statements.



TABLE 7  
NUMBER AND PERCENTAGE OF MEMBERS IN VARIOUS WHITE GRADE-GROUPS WHO HAD A  
PREFERENCE-PERCENTAGE SCORE FOR NEGROES HIGHER THAN .500

Judges Group judged	Males		Females	
	Males	Females	Males	Females
	<i>Number</i>			
Grade 2	6	3	0	3
Grade 4	4	1	1	1
Grade 6	2	2	1	0
Grade 8	7	3	1	4
Grade 10	0	0	0	0
Grade 12	0	0	0	0
	<i>Percentage</i>			
Grade 2	24	12	0	14
Grade 4	18	5	4	4
Grade 6	8	8	5	0
Grade 8	22	9	3	14
Grade 10	0	0	0	0
Grade 12	0	0	0	0

that such expressions of preference as we obtained, although far from faultless, would reveal the attitudes we wanted to uncover better than a measure of frequency of contact, since the association of any two children is a function in part of external contingencies as well as of the attitudes of *both* individuals toward each other. A child may not associate with another child not because he does not like the latter but because he is too shy to make advances, or because the latter child rebuffs him. We do, of course, want to make it clear that we realize propinquity or opportunity for association is a factor in determining children's friendships (7, 16) and that what we have called a race variable may reduce in part to a frequency of association variable, since the children of a given racial group may live near each other and build up more community of interest through more frequent contacts than is possible with classmates of another race. Race feeling, as we said before, we believe, stems from many sources.

We should also make it clear, before we go further, that we know children are judged by their classmates in terms of many considerations other than race and race correlates (5, 7, 16) but we do, in spite of this fact, feel that if there exists in a population a very substantial bias for or against the members of a given race, this bias being a constant force, broad in scope, should make itself felt in the judgment frequencies which we shall compare, especially if these frequencies have considerable magnitude.

We might mention also at this point that in the case of the grade schools studied many of the children knew each other only rather casually. Most

TABLE 8  
NUMBER AND PERCENTAGE OF THE MEMBERS IN VARIOUS NEGRO SKIN-COLOR GRADE-GROUPS WHO HAD A PREFERENCE-  
PERCENTAGE SCORE FOR WHITES HIGHER THAN .500

Judges Group judged	Light males		Light females		Medium males		Medium females		Dark males		Dark females	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
<i>Number</i>												
Grade 2	1	5	6	6	8	9	9	5	8	7	5	2
Grade 4	4	4	3	4	8	11	3	4	6	6	2	2
Grade 6	0	3	4	7	2	4	5	14	3	8	4	4
Grade 8	2	2	1	2	1	0	1	3	1	4	0	0
Grade 10	0	0	0	0	0	0	0	0	0	0	0	0
Grade 12	0	0	0	0	0	0	0	0	0	0	0	0
<i>Percentage</i>												
Grade 2	16	83	86	86	38	43	82	45	53	47	83	33
Grade 4	50	50	38	50	44	61	25	33	46	46	33	33
Grade 6	0	100	40	70	18	36	28	78	17	44	44	43
Grade 8	50	50	14	29	7	0	8	23	10	40	0	19
Grade 10	0	0	0	0	0	0	0	0	0	0	0	0
Grade 12	0	0	0	0	0	0	0	0	0	0	0	0
Mean	19	47	30	39	18	23	24	30	21	29	27	18
												Mean
												58
												42
												43
												19
												0
												0
												0
												0

TABLE 9  
CRITICAL RATIOS FOR THE DIFFERENCES IN GRADE-GROUP MEANS OF THE RACE-PREFERENCE-PERCENTAGE SCORES OF VARIOUS  
GROUPS OF JUDGES FOR CLASSMATES OF THE RACE OF THE JUDGES

Judges Group judged	White males		White females		Negro males		Negro females	
	Males	Females	Males	Females	Males	Females	Males	Females
Grade 2 vs. Grade 4	-.400	-.143	+1.469	-.048	-.870	-.440	-3.457	-2.389
" 2 " " 6	-2.195	-2.478	-1.962	-2.854	-3.606	+.575	-4.000	+.805
" 2 " " 8	-1.963	-2.565	-1.371	-1.309	-6.459	-2.513	-6.933	-4.481
" 4 " " 6	-1.682	-2.298	-2.865	-3.163	-2.676	+.850	-1.049	+2.644
" 4 " " 8	-1.643	-2.383	-2.794	-1.429	-5.475	-2.231	-4.244	-2.673
" 6 " " 8	-.281	-.078	+1.000	+1.393	-2.553	-2.420	-2.960	-4.586

A negative sign means that the higher grade mean was the larger.

TABLE 10

CRITICAL RATIOS FOR THE DIFFERENCES, WHEN MALES AND FEMALES ARE BEING JUDGED, OF GRADE-GROUP WHITE-RACE PREFERENCE-PERCENTAGE-SCORE MEANS

Judging groups whose means are compared	White males vs. Negro males		White females vs. Negro females		
	Group judged	Males	Females	Males	Females
Grade 2		+ 6.950	+9.000	+ 4.739	+ 5.870
" 4		+ 7.955	+7.391	+ 8.318	+11.150
" 6		+10.235	+7.394	+ 9.146	+ 6.475
" 8		+ 8.679	+9.000	+11.439	+ 6.875

A positive sign means the first item in the comparison is the larger.

TABLE 11

CRITICAL RATIOS FOR THE DIFFERENCES BETWEEN VARIOUS SEX-GROUP MEAN RACE-PREFERENCE-PERCENTAGE SCORES FOR CLASSMATES OF THE RACE OF THE JUDGES

Judging groups whose means are compared	White males vs. White females		Negro males vs. Negro females		
	Group judged	Males	Females	Males	Females
Grade 2		—3.619	—1.000	+4.609	+2.222
“ 4		— .419	— .783	+ .313	—1.591
“ 6		—2.146	—2.600	+1.743	+2.632
“ 8		— .390	+1.200	+ .892	—1.863

A negative sign means the second item in the comparison is the larger; i.e., that, the females tended to have the stronger preference for the members of their own race.

TABLE 12

CRITICAL RATIOS FOR THE DIFFERENCES, WHEN OWN- AND OPPOSITE-SEX GROUPS ARE JUDGED, BETWEEN MEAN PREFERENCE-PERCENTAGE SCORES FOR CLASSMATES OF THE RACE OF THE JUDGES

Judging groups whose means are compared	White males vs. White females		Negro males vs. Negro females		
	Group judged	Own sex	Opposite sex	Own sex	Opposite sex
Grade 2	—1.209	—1.243	+2.240	+2.903	
“ 4	—1.000	+ .189	— .286	— .667	
“ 6	—2.204	— .576	+4.522	—1.980	
“ 8	— .250	+ .546	+1.051	—2.431	

A negative sign means that the mean when females were judging exceeded the mean for the males.

TABLE 13

CRITICAL RATIOS FOR THE DIFFERENCES, WHEN MALES AND FEMALES ARE BEING JUDGED,  
OF THE MEAN RACE-PREFERENCE-PERCENTAGE SCORES FOR CLASSMATES  
OF THE RACE OF THE JUDGES

Judged groups whose means are compared	White males vs. White females		Negro males vs. Negro females	
	Judges	White males	Negro males	Negro females
Grade 2		-1.000	+ .750	+ .800
" 4		-.769	-.893	-1.136
" 6		-1.350	-.756	+3.160
" 8		-.851	.000	+5.414

A negative sign means that the mean when females were judged was higher than when males were judged.

TABLE 14

SIGMAS OF THE DISTRIBUTIONS AND OF THE MEANS OF THE RACE-PREFERENCE-PERCENTAGE  
SCORES OF THE CHILDREN IN VARIOUS SEX-RACE GROUPS AT VARIOUS GRADE LEVELS

Groups judging	White males		White females		Negro males		Negro females	
Groups judged	Males	Females	Males	Females	Males	Females	Males	Females
<i>Sigmas of the Distributions</i>								
Grade 2	.131	.147	.107	.156	.072	.114	.121	.107
" 4	.140	.139	.108	.116	.121	.105	.126	.150
" 6	.160	.175	.201	.176	.178	.204	.203	.209
" 8	.267	.201	.140	.234	.184	.188	.198	.250
<i>Sigmas of the Means</i>								
Grade 2	.026	.029	.023	.034	.011	.018	.025	.022
" 4	.030	.030	.022	.024	.020	.017	.025	.029
" 6	.032	.036	.047	.043	.031	.036	.033	.034
" 8	.047	.036	.026	.043	.035	.035	.037	.047

of the classmates had associated at school for at least a semester, but long association with each other on the part of individual children was probably the exception rather than the rule. In a setting of this sort we should expect such obvious characteristics as sex and race to weigh more heavily in determining classmate preferences than, for instance, many unique personal qualities which are more subtle and are understood only slowly. Since our high-school subjects were much better acquainted with each other, in the main, than were the grade-school children, this fact will have to be taken into account in interpreting our results.

The statistic which we thought would reveal roughly for a given child the extent of race preference was the percentage of times in the case of his choices between pairs of names involving only members of the same sex

TABLE 15

SIGMAS OF THE DISTRIBUTIONS OF THE RACE-PREFERENCE-PERCENTAGE SCORES OF THE CHILDREN IN VARIOUS SEX-RACE GROUPS

Group judging Group judged				White males		Negro males		White females		Negro females	
				Males	Females	Males	Females	Males	Females	Males	Females
School	II, Grade	2		.104	.073	.078	.110	.024	.125	.095	.073
"	"	4		.130	.192	.122	.153	.063	.189	.102	.128
"	"	6		.025	.300	.151	.191			.167	.166
"	"	8		.172	.204	.197	.222	.025	.050	.140	.251
School	III, Grade	2		.063	.053	.046	.083	.074	.172	.093	.092
"	"	4		.118	.127	.124	.121	.089	.085	.126	.127
"	"	6		.125	.164	.146	.147	.214	.158	.205	.167
"	"	8		.193	.196	.167	.149	.189	.114	.123	.201
School	IV, Grade	2		.133	.147	.079	.063	.099	.146	.087	.096
"	"	4		.149	.117	.125	.069	.113	.104	.125	.161
"	"	6		.082	.144	.082	.220	.234	.162	.234	.068
"	"	8		.314	.199			.100	.252	.425	.000
School	V, Grade	10		.139	.075			.050	.075	.071	.000
"	"	12		.152	.078			.108	.150	.047	.147

but individuals of different races he favored the members of a given race. For each white boy in a class room, for example, it was noted what percentage of the times (a) when he was asked to express a preference for one of two classmates and these were a white and negro boy he chose the white boy, and (b) when the choices were between the two girl classmates—a white and a negro—he chose the white girl. The percentage of times the child favored a negro classmate is, then, 1.00 minus the percentage of his choices favoring a white. The mean of these percentages of favorable choices given white boys, negro boys, white girls, and negro girls were computed separately for the groups of white boys, white girls, negro boys, and negro girls. We have presented the data for the four groups of judges separately because we had reason to believe that the various sex and racial groups might show somewhat different preference patterns.

## B. RESULTS

It is clear that our white subjects tended more frequently to express a preference for classmates of their own race than they did for classmates of the negro race. In fact, only 39 out of 584 scores show a contrary trend (Table 7). One can see, moreover, from Table 3 that the mean preference-percentage score for whites of all groups of white judges, with one exception, is over .500. The one exception in 55 means occurs in the case of a second-grade group of boys when judging classmates who were girls; and even in the case of this group, the median ratio is over .500.



TABLE 17  
NUMBER AND PERCENTAGE OF NEGRO SUBJECTS IN VARIOUS SKIN-COLOR GROUPS

			Number of subjects						Percentage of total grade group in various skin-color groups		
			Light males	Medium males	Dark males	Light females	Medium females	Dark females	Light	Medium	Dark
School	I, Grade	2	3	12	5	6	9	6	22	51	27
"	"	"	4	6	4	7	4	13	24	40	36
"	"	"	6	5	6	3	3	16	20	55	25
"	"	"	8	3	6	5	7	8	28	39	33
School	II, Grade	2	1	9	7	5	7	3	19	50	31
"	"	"	4	3	7	7	6	3	18	46	36
"	"	"	6	0	5	10	2	11	6	52	42
"	"	"	8	2	7	5	4	8	20	50	30
School	III, Grade	2	3	10	6	0	3	2	13	54	33
"	"	"	4	1	8	6	1	5	8	54	38
"	"	"	6	1	5	7	5	4	21	41	38
"	"	"	8	1	7	5	3	4	17	44	39
School	IV, Grade	2	2	2	2	2	1	1	40	30	30
"	"	"	4	4	3	0	5	1	69	31	0
"	"	"	6	2	1	1	3	0	56	11	33
"	"	"	8	1	0	0	2	0	33	67	0

The white pupils, then, even the second-graders, showed, on the average, a fairly clear-cut preference for classmates of their own race, and this favorable bias of whites for whites appeared to mount in strength through the grades up through at least the tenth, where almost complete stratification along racial lines seemed to exist. (See also References 5 and 14.) The successive grade groups between whose mean preference-percentage scores the differences were greatest were the fourth and sixth and the eighth and tenth (Table 5). It is possible, of course, since the high-school group represented a different population than the grade-school group did, that the sharp increase of the tenth-grade preference-percentage-score means over the eighth, stems more from the effects of class or cultural differences than from a developmental trend within a given population. However, that the course of development in race feeling in the population represented by the grade schools would continue upward, though not necessarily sharply so, we should expect on the basis of such findings as Minard's (13).

Since the large increase in self preference of the sixth-grade whites over the fourth-grade is found uniformly only in the data for School IV, the one with the small negro minority, we are not sure that the rate of the inter-grade change in the population we studied should be described as irregular.

TABLE 18  
NUMBER OF JUDGMENTS UPON WHICH WEIGHTED MEANS OF GROUP SKIN-COLOR-PREFERENCE SCORES ARE BASED

Group judging	Whites		Negro males		Negro females		Second- graders	Fourth- graders	Sixth- graders	Eighth graders
	Males	Females	Light	Medium	Dark	Light	Medium	Dark		
Groups judged										
Negro males— Light vs. medium	784	645	506	1,406	1,116	799	1,763	1,030	2,381	1,361
Negro females— Light vs. medium	806	657	1,090	2,510	2,091	1,308	3,130	1,996	2,836	3,357
Negro total— Light vs. medium	1,590	1,302	1,596	3,916	3,207	2,107	4,893	3,026	5,217	4,718
Negro males— Light vs. dark	500	381	424	1,116	796	595	1,448	870	2,577	1,045
Negro females— Light vs. dark	556	417	653	1,517	1,227	850	1,996	1,034	1,580	2,670
Negro total— Light vs. dark	1,056	798	1,077	2,633	2,023	1,445	3,444	1,904	3,657	3,715
Negro males— Medium vs. dark	2,113	1,561	1,116	3,422	2,720	1,728	3,771	2,096	4,369	3,540
Negro females— Medium vs. dark	800	615	1,728	3,182	2,761	1,996	4,786	2,402	3,162	3,468
Negro total— Medium vs. dark	2,913	2,176	2,844	6,604	5,481	3,724	8,557	4,498	10,131	7,008

What appears to be an acceleration in self-preference increase in School IV between the fourth and sixth grades may be a function of the particular constellation of children in the classes of that school and no accurate reflection of any developmental trend in race attitude. It is interesting in connection with this whole question, however, that Criswell asserts it is in the fifth grade that the mutual withdrawal of the races crystalizes.

The magnitude of the race cleavage at the lower grade-school levels, as far as the whites were concerned, seems to have been about that of the sex cleavage we reported earlier for the same children (9) or even slightly less; but at the high-school level the race cleavage was distinctly greater than the sex (Tables 3 and 16).

In contrast with the data reflecting a strong tendency toward a white preference on the part of whites, even the youngest, are the results for the negro children. In 203 instances out of 542 is the negro child's preference-percentage score for negroes below .500 (Table 8). Thirteen of the 16 distributions in which no colored child's score indicates he favored the whites in his choices occur in the case of classes at the eighth-grade and high-school levels. In fact, at the eighth-grade and high-school levels no group mean or median preference-percentage score of the negroes falls below .500 (Table 3). On the other hand, in the grades below the eighth there are 17 group means, distributed about equally between the second, fourth, and sixth grades, which tend to indicate a trend on the part of the colored pupils to favor white rather than negro classmates. In one school, however, the one in which the negroes had only a small majority, only one mean out of the 12 for the grades below the eighth shows such a trend. Of this we shall have more to say later.

At all grades levels up to the eighth, especially among the negro girls, the sex cleavage was conspicuous and was considerably greater than the race.

When all of our data are pooled and summarized by grade (Tables 5, 8, 9, and 21), it seems quite clear, then, that the youngest negro children, except perhaps males when judging males, and the negroes in the population in which the whites and colored were represented in about equal proportions, favored their white classmates. (See Criswell for a report of a similar trend.) However, by the time the eighth grade had been reached, at least the confessed bias of the colored children was distinctly pro-negro, barring possibly that of the light negro male when judging females. In the high school the negroes' preference for negroes was as strong as the whites' preference for whites. In fact, there was almost complete withdrawal from the whites. The increase in the strength of the expressed preference of negro

TABLE 19  
WHITE AND NEGRO JUDGES' GRADE-GROUP PREFERENCE-PERCENTAGE SCORE MEANS FOR NEGRO CLASSMATES BELONGING TO  
VARIOUS SKIN-COLOR GROUPS

Judges Piement group judged	Light males			Medium males			Dark males			Light females		
	Light	Medium	Dark	Light	Medium	Dark	Light	Medium	Dark	Light	Medium	Dark
Grade 2												
Males, light vs. medium	.470	.530		.519	.481		.522	.478		.520	.480	
Females, " " "	.512	.488		.461	.539		.497	.503		.454	.546	
Total	.496	.504		.486	.514		.508	.492		.480	.520	
Males, light vs. dark	.343		.657	.506		.494			.515	.571		.429
Females, " " "	.449		.551	.449		.504	.536		.454	.504		.496
Total	.411		.589	.500		.500	.515		.485	.528		.472
Males, medium vs. dark	.499		.501	.526		.474		.530	.470		.552	.448
Females, " " "	.527		.473	.526		.474		.556	.444		.492	.508
Total	.508		.492	.526		.474		.559	.461		.529	.471
Grade 4												
Males, light vs. medium	.530	.470		.489	.511		.438	.562		.539	.461	
Females, " " "	.622	.378		.669	.331		.626	.374		.548	.452	
Total	.590	.410		.589	.411		.545	.455		.543	.457	
Males, light vs. dark	.643		.357	.595		.405			.500	.699		.301
Females, " " "	.714		.286	.799		.201	.704		.296	.716		.284
Total	.675		.325	.666		.334	.584		.416	.704		.296
Males, medium vs. dark	.609		.391	.595		.405		.561	.439		.643	.357
Females, " " "	.633		.367	.653		.347		.590	.410		.647	.353
Total	.625		.375	.623		.377		.578	.422		.646	.354
Grade 6												
Males, light vs. medium	.516	.484		.241	.759		.488	.512		.364	.636	
Females, " " "	.695	.305		.617	.383		.624	.376		.643	.357	
Total	.640	.360		.555	.445		.601	.399		.554	.446	
Males, light vs. dark	.516		.484	.425		.575			.667	.477		.523
Females, " " "	.686		.314	.649		.351	.546		.454	.736		.264
Total	.633		.367	.576		.424	.501		.499	.637		.363
Males, medium vs. dark	.583		.417	.581		.419		.522	.478		.651	.349
Females, " " "	.471		.529	.497		.503		.466	.534		.531	.469
Total	.491		.509	.523		.477		.491	.509		.577	.423
Grade 8												
Males, light vs. medium	.280	.720		.334	.666		.369	.631		.478	.522	
Females, " " "	.598	.402		.416	.584		.402	.598		.549	.451	
Total	.543	.457		.395	.605		.393	.607		.527	.473	
Males, light vs. dark	.300		.700	.374		.626			.675	.563		.437
Females, " " "	.675		.325	.602		.398	.522		.478	.634		.366
Total	.610		.390	.557		.463	.475		.525	.612		.388
Males, medium vs. dark	.528		.472	.500		.500		.563	.437		.484	.516
Females, " " "	.643		.357	.672		.328		.588	.412		.594	.406
Total	.592		.408	.591		.409		.577	.423		.544	.456

TABLE 19 (continued)

Judges Pigment group judged	Medium females			Dark females			White males			White females		
	Light	Medium	Dark	Light	Medium	Dark	Light	Medium	Dark	Light	Medium	Dark
<b>Grade 2</b>												
Males, light vs. medium	.503	.497		.518	.482		.404	.596		.432	.568	
Females, " " "	.502	.498		.483	.517		.440	.560		.580	.420	
Total, " " "	.502	.498		.497	.503		.419	.581		.486	.514	
Males, light vs. dark	.533		.467	.576		.424	.528		.472	.546		.454
Females, " " "	.508		.492	.543		.437	.491		.509	.491		.409
Total, " " "	.517		.483	.557		.443	.515		.485	.560		.440
Males, medium vs. dark		.552	.448		.603	.397		.553	.447		.547	.453
Females, " " "		.491	.509		.509	.491		.583	.417		.642	.358
Total, " " "		.532	.468		.573	.427		.559	.441		.563	.437
<b>Grade 4</b>												
Males, light vs. medium	.492	.508		.505	.495		.587	.413		.567	.433	
Females, " " "	.609	.391		.537	.463		.638	.362		.660	.340	
Total, " " "	.561	.439		.525	.475		.604	.396		.597	.403	
Males, light vs. dark	.618		.382	.609		.391	.600		.400	.657		.343
Females, " " "	.668		.332	.566		.434	.333		.167	.916		.084
Total, " " "	.638		.362	.593		.407	.660		.340	.726		.274
Males, medium vs. dark		.609	.391		.563	.437		.560	.440		.646	
Females, " " "		.579	.421		.550	.450		.512	.488		.597	.403
Total, " " "		.591	.409		.555	.445		.548	.452		.634	.366
<b>Grade 6</b>												
Males, light vs. medium	.394	.606		.427	.573		.410	.590		.273	.727	
Females, " " "	.659	.341		.648	.352		.636	.364		.520	.480	
Total, " " "	.577	.423		.581	.419		.583	.417		.478	.522	
Males, light vs. dark	.571		.429	.526		.474	.469		.531	.522		.478
Females, " " "	.642		.358	.652		.348	.665		.335	.697		.393
Total, " " "	.617		.383	.601		.399	.617		.383	.585		.415
Males, medium vs. dark		.620	.380		.617	.383		.659	.341		.617	.383
Females, " " "		.480	.520		.504	.496		.466	.534		.445	.555
Total, " " "		.527	.473		.542	.458		.580	.420		.543	.457
<b>Grade 8</b>												
Males, light vs. medium	.376	.624		.438	.562		.536	.464		.800	.200	
Females, " " "	.473	.527		.482	.518		.532	.468		.432	.568	
Total, " " "	.443	.557		.470	.530		.534	.466		.569	.431	
Males, light vs. dark	.526		.474	.515		.485	.600		.400	.780		.220
Females, " " "	.547		.453	.558		.442	.560		.440	.673		.327
Total, " " "	.541		.459	.545		.455	.573		.427	.707		.293
Males, medium vs. dark		.626	.374		.563	.437		.476	.524		.461	.539
Females, " " "		.527	.473		.600	.400		.572	.428		.714	.286
Total, " " "		.575	.425		.581	.419		.510	.490		.543	.457

TABLE 20  
NEGRO SKIN-COLOR-GROUP PREFERENCE-PERCENTAGE-SCORE MEANS OF VARIOUS GROUPS OF JUDGES  
(Data from all grade groups in four schools)

Judges Pigment group judged	White			Light Negro			Medium Negro			Dark Negro		
	Light	Medium	Dark	Light	Medium	Dark	Light	Medium	Dark	Light	Medium	Dark
<i>Males</i>												
Males	.470	.530		.449	.553		.423	.577		.443	.537	
Females	.581	.419		.609	.391		.534	.466		.549	.451	
Total	.535	.465		.568	.432		.512	.488		.524	.476	
Males	.549		.451	.441		.559	.490		.510	.424		.576
Females	.654		.346	.633		.367	.651		.349	.586		.414
Total	.598		.402	.587		.413	.575		.425	.519		.481
Males		.563	.437		.559	.441		.558	.442		.535	.465
Females		.528	.472		.574	.426		.583	.417		.549	.451
Total		.548	.452		.568	.432		.567	.433		.535	.465
<i>Females</i>												
Males	.505	.495		.485	.515		.454	.546		.479	.521	
Females	.532	.468		.582	.418		.568	.432		.538	.462	
Total	.527	.473		.546	.454		.528	.472		.523	.477	
Males	.637		.363	.596		.404	.577		.423	.573		.427
Females	.715		.285	.684		.316	.607		.393	.587		.413
Total	.649		.351	.644		.356	.586		.414	.578		.422
Males		.568	.432		.584	.416		.605	.395		.585	.415
Females		.596	.404		.571	.429		.520	.480		.539	.461
Total		.570	.430		.573	.427		.556	.444		.563	.437

TABLE 21  
WHITE-PREFERENCE-PERCENTAGE SCORE MEANS OF NEGROES IN VARIOUS SKIN-COLOR GROUPS IN VARIOUS GRADES

Judges	Males			Females			Males			Females			Weighted Mean	Males	Females
	Light	Medium	Dark	Light	Medium	Dark	Light	Medium	Dark	Light	Medium	Dark			
Group judged	Males			Females			Males			Females					
Grade 2	.455	.486	.493	.607	.577	.528	.576	.507	.518	.598	.535	.517	.516	.532	
" 4	.470	.427	.474	.456	.481	.475	.519	.520	.472	.501	.456	.444	.460	.493	
" 6	.205	.380	.364	.457	.414	.473	.656	.405	.442	.482	.502	.435	.403	.466	
" 8	.424	.174	.286	.373	.289	.266	.608	.337	.432	.404	.317	.131	.263	.350	
Weighted															
Mean	.409	.377	.402	.493	.437	.426	.583	.458	.462	.524	.456	.384			

TABLE 22  
MEAN PREFERENCE-PERCENTAGE SCORES OF VARIOUS GROUPS OF JUDGES IN THE CASE OF  
VARIOUS NATIONALITY GROUPS

Groups judged	Non-Italian Males	Italian Males	Non-Italian Females	Italian Females	Non-Italian Males	Italian Males	Non-Italian Females	Italian Females
	Non-Italian males				Non-Italian females			
Grade 2	.522	.478	.554	.446	.540	.460	.567	.433
" 4	.404	.596	.503	.497	.511	.489	.535	.465
" 6	.522	.478	.453	.547	.569	.431	.474	.526
" 8	.559	.441	.503	.497	.578	.422	.527	.473
Judges	Italian males				Italian females			
Grade 2	.520	.480	.520	.480	.542	.458	.507	.493
" 4	.451	.549	.534	.466	.446	.554	.538	.462
" 6	.574	.426	.417	.583	.532	.468	.393	.607
" 8	.382	.618	.554	.446	.575	.425	.412	.588

children for negro classmates was especially abrupt between the sixth- and eighth-grade level—a finding which is in line with one noted by Criswell (5). It is interesting that this sharpening of their preference for the members of their own racial group seems to have occurred slightly later among negroes than among whites. This lag, as well as the favoring of the whites by the young negro, we suspect reflects the drag or counter-pressure upon the values which racial identification would dictate, of the values of the larger social group in which the negro in this country is a minority.

Of course, how far even the older negro child's deepest yearnings have changed or how far our findings express merely the pose he believes he is expected to assume, or the superficial attitude he is driven to by the humiliations he has suffered as a result of being a member of an unfavored minority in our country, is a question (3).

That the social distance between our adolescent subjects of the white and negro races was as great as it was, indicates little that is encouraging relative to the effectiveness of our educational program for combating the growth of racial bias. It is true one might argue that our data cannot be said to be adumbrative of prejudice—a quantity which contains the implication of a negative valence—but we should find it difficult to believe that at least those children who very consistently expressed a preference for classmates of their own race had no prejudice. To support the hypotheses that we are dealing to some degree with prejudice, we would refer the reader to the investigations of Minard (13) and of Meltzer (11). Meltzer's subjects, for example, who were mostly white American school children in the upper grades and who were asked to tell how much they liked or disliked children of

TABLE 23  
NUMBER OF JUDGMENTS MADE BY VARIOUS GROUPS OF JUDGES IN THE CASE OF VARIOUS NATIONALITY GROUPS

Judges Group judged	Non-Italian males		Non-Italian females		Italian males		Italian females	
	Males	Females	Males	Females	Males	Females	Males	Females
School VI,								
Grade 2, Test I	504	672	672	672	924	1,152	1,008	1,056
" 2, " II	504	672	672	672	924	1,152	1,008	1,056
" 4, " I	880	1,287	1,144	1,404	616	936	792	936
" 4, " II	720	1,170	1,070	1,404	560	936	720	936
" 6, " I	468	1,300	390	900	78	300	390	900
" 6, " II	396	1,200	360	900	72	300	360	900
" 8, " I	1,456	1,120	1,792	1,200	784	640	560	320
" 8, " II	1,456	1,050	1,680	1,050	784	600	560	300

various races and nationalities, typically expressed a dislike for negroes and the degree of the expressed dislike increased with grade.

As far as the variability in attitude in a classroom group is concerned, little that is consistent is apparent in our findings, except that at least up to the sixth grade the variability of both negroes and whites seems to increase. (See Tables 14 and 15.) Twenty-one out of 24 possible comparisons between parallel second- and fourth-grade groups reveal the fourth-graders to have been the more variable (Table 15) and in 18 out of 22 comparisons, the sixth-graders appear more variable than the fourth. Beyond the sixth grade our data do not reveal consistent increases, though there is a suggestion in Table 14 that the variability continues upward through the eighth grade. That the high-school children were more homogeneous in attitude than the older grade-school groups were, may mean that in our suburban community race attitudes are more uniform than they are in the city or that by the time the children have reached high school, the leveling effects of certain constant cultural pressures have come to mask the effects of other vectors making for diversity. It is significant in this connection that the distributions of the scores of at least the eighth-grade and high-school children are clearly J-shaped—i.e., the frequency curves are like Allport's "social conformity" curves.

Although the critical ratios are small, there is some consistency in the indication in our data that the white girls had a stronger preference for classmates of their own race than did the white boys. (See Tables 3, 5, 11, and 12.) This trend is apparent when the boys' and girls' attitudes toward the same groups of individuals are compared, as well as when the white girls' favorable bias toward white girls is compared with the white boys' favorable bias toward white boys. When judging males, the sexes differed more in the degree of white preference they showed than when judging females. A similar sex divergence in degree of preference for classmates of their own race is not clearly evident in the case of the data for negro groups. In fact, if any sex difference existed, it was the negro boy, at least when boys were judged, that exhibited the greater degree of pro-negro bias.

That the white girls expressed a slightly stronger preference for classmates of their own race than white boys did may mean the girls were more influenced by general cultural pressures than were the boys. Other studies have shown, for example, that girls in our culture tend to be the greater conformists (1, 2, 4, 8, 10, 15, 17). If this is the trend, then the fact of no consistent sex difference among the colored children leaves us with something to explain. It is, of course, not out of the realm of the possible that

different cultural patterns obtain in the case of the two racial groups. White parents in our culture, for example, may take more pains to teach their daughters race prejudice than they do their sons, feeling the former the more threatened; whereas negro parents may do and feel the reverse. A text such as Frazier's (6), for instance, suggests that the negro woman has through the years had more successful contacts with the whites than has the negro man.

Perhaps, too, the stronger preference for white classmates displayed by our white girls, in contrast with our white boys, was a compensation phenomenon. Having the unfavorable classification of female—the culture being male dominated—the girls may have tended to overemphasize identifications with groups having a favored status, e.g., identifications such as that with a favored race. Our negro girl subjects, on the other hand, feeling more unfavored or less favored in the matter of race than sex—the negro culture being probably still a matriarchal one (6)—would have had occasion to use their sex identification as a compensation for a not too satisfying race identification instead of vice versa. Our finding, published earlier (9), that the negro girls' preference for classmates of their own sex was consistently stronger than was the negro boys' preference for boy as opposed to girl classmates, is at least not out of line with the compensation hypothesis just advanced.

Differences in matriarchal and patriarchal trends in negro and white cultures may be in part responsible also for the fact that, when judging girls, our colored boys tended to show their preference for the members of their own race less than when judging boys, whereas the reverse obtained in the case of the whites. Perhaps when a judge is choosing among the members of a culturally favored sex group, racial considerations are less important determinants of his choice and other more personal considerations relatively more weighty ones than is the case when his choices are made from among the members of a culturally less favored sex group. The negro boy, for example, having a relatively strong favorable conditioning toward the female, should show, then, as our data indicate, more race prejudice when judging boys than when judging girls, whereas the white boys, being sensitive to the doctrine of the superiority of the male, should show, as our subjects did, more race prejudice when judging girls. The white grade-school boy, perhaps feeling distant from all girls at best, and knowing them little, may make his choice among them on the basis of the superficial or obvious characteristic of race to a large extent, and when this is done, of course his own racial group is favored. The white boys' choices among

males, as contrasted with females, may be conditioned to a greater degree by other personal qualities in those judged than their race. The negro boy, on the other hand, in spite of his matriarchal conditioning, probably has more contacts with white boys than girls. In the normal give and take of school life, it is too much to expect that the whites would not have used their favored position to discomfit the negro boys and this discomfiture would then have been experienced by the colored boys more frequently at the hands of white boys than girls.

Whether the majority-minority relationships obtaining in the populations we studied have had an influence on the race preference patterns seen in our data, we hesitate to say, partly because (*a*) the number of cases in a minority in a class-room group is necessarily small, and, hence, the effect of the race variable is likely to be masked by that of others, and (*b*) we discovered that the districts in which the schools we studied were located were not similar in probably important respects, such as the tempo of population change. In the area in which the school having the small negro minority was located—i.e., School IV—a political-economic struggle involving racial issues was at white heat and the shift in population character rapid. The schools in which the negroes predominated were located, on the other hand, in neighborhoods whose racial composition has been fairly stable in recent years.

Whatever it may mean, the white boys of School III, the school in which the incidence of whites and negroes was most nearly equal, tended to express a less strong white preference than did the white boys in Schools II or IV. (See Tables 3 and 6.) The trend in the case of the girls seems to have been in the same direction, but it was not so consistent nor pronounced. Interestingly enough, there is a suggestion that it was also in School III that the preference expressed by negroes for colored classmates was the strongest. It is worthy of note that this finding confirms Criswell's observation that the younger grade-school negroes show self preference only when they are about equal in number to the whites, i.e., the negroes up to or through the sixth grade are inclined to favor the whites unless the white minority is very large, in which case the negroes from the first grade on tend to prefer the members of their own race. It is also significant that, if we do not take too literally his exact definition of the lower boundary of the minority range in which the trend can occur, our finding with respect to the relative depression of white self preference in School III is also in line with Criswell's observation that when whites have a very large minority the degree of their preference for their white classmates tends to be relatively low.

A comparison of the data for Schools II and IV in Table 6, although again the evidence is tenuous, reveals that when the judges chose among classmates of their own sex, whether the judges were white or negro, male or female, they tended to show a stronger preference for those of their own race when their racial group constituted a small minority of the class population than when it constituted a large majority, while the reverse tendency obtained, albeit less consistently and markedly, when the judges chose among classmates of the opposite sex.

Although, as we have confessed, we are uncomfortable about interpreting any of our findings relative to majority-minority relations, we mention our results because they agree with Criswell's on many counts. However, they differ in some respects which we should probably describe. While no sex difference is apparent in our data, for instance, Criswell thinks boys reject the members of small minorities more than the members of large, whereas the reverse tendency holds for girls.

Since the data presented thus far can be construed as indicating that differences which readily set one group apart from another physically contribute strongly in our competitive culture towards creating a social chasm between the groups, it occurred to us that among the negroes themselves there probably were sub-groups, which by virtue of greater similarity in skin color and perhaps feature to the whites, might be relatively popular with the latter. Hence, we have organized our data to throw some light on the following questions: Do the whites tend to prefer the light negro to the medium-brown or dark? Does a preference trend favorable to those of their own racial kind which most resemble the white race exist among negroes, and if so, does it exist equally strongly among colored children of different degrees of duskiness? Is the degree of brownness preferred by negroes different for the members of the two sexes? Does the popularity of a given coloring change as the judges age, and this differently for the members of the skin-color groups? Do negroes in a given pigmentation group admire most individuals most like themselves?

The grouping of our negro subjects on the basis of the darkness of their skin pigmentation was done fairly arbitrarily. Before our subjects were questioned regarding their classmate preferences, the Experimenter and her assistant, using a color chart as a guide, rated independently each child on a three-point scale. The number of agreements between the raters was high. After rating independently, the two judges compared notes and reconsidered, with the doubtful subjects before them, the cases on which there had been disagreement. Usually it was not difficult then to concur. (See Table 17

for the percentages of our negro subjects falling in the three skin-color groups.)

The pigment-preference-percentage scores were computed just as were the race-preference-percentage scores. The percentage of times a subject, when presented with choices among individuals of the same sex and race but differing in depth of pigmentation, chose those in a particular pigment group, was computed. Degree of preference was estimated for light as opposed to medium-brown negroes, for light as opposed to very dark, and for medium-brown as opposed to dark.

Since the children in each skin-color group in a class tended to be few, we have combined our data from the various schools in such a way as to mass the results for a given grade level and for type of judge. (See Tables 19, 20, and 21.) The data for each school were weighted in accordance with the number of choices expressed by the contributing group from the school.

When the data from all schools and grades are pooled (Table 20), it appears that in the case of every group of judges the medium-brown negro classmates were preferred, on the average, to the very dark, and in every instance but those of male negroes of all pigmentation groups when judging males, the light classmates were preferred, on the average, to the dark. Even the older colored boys, who seemed to favor dark males over light, tended, nevertheless, to prefer the light negro girls to the dark. Hence, it seems safe to say that at least very dark pigmentation is not looked upon with favor, and that in girls the very light skin color is appreciated. The percentages of judgments favoring light girls over the medium-brown and dark are consistently over .500 and greater than comparable measures for the boys (Table 20).

Perhaps the same tendency to prize lightness in females more than in males is seen in the fact that, in the case of all judges but the dark girls, the mean frequency of the judgments favoring the whites, when the choices were between white and negro classmates, is greater when girls were judged than when boys were (Table 21). Apparently others than gentlemen prefer "blondes."

Just why the very light negro boy in our groups, especially at the sixth- and eighth-grade levels, was not more popular is a question. Possibly our cases were not numerous enough to give us dependable results. That our finding is a statistical accident seems unlikely, however, since the stock of the light negro boy tended to decrease consistently with grade (Table 19). It is noteworthy in this connection also that even in the case of the girls, in whom

lightness seems to have been valued, there was evidence of a tendency in the eighth grade for the negro judges of the two darker groups to prefer the medium-brown to the very light. Perhaps some of the light negroes have made themselves unpopular by trying to avoid identification with the colored, i.e., by holding themselves aloof. Tables 21 and 8, for example, show, though slightly to be sure, that the light negroes more frequently expressed a preference for white classmates over negroes than the medium-brown and dark colored children did. The preference of the light negro boys for white girls seems even to have increased with grade. It seems possible also that the light negro boy may have been rejected by the older colored children in part because he was the least typically negroid rather than merely because he himself was trying to avoid identification with the negro.

Some of our results in the case of the negro we believe can be given a rational interpretation in terms of the effects of three vectors, the relative weights of which vary with the children's age and understanding, sex, and depth of pigmentation. One force presses in the direction of the values of the larger white culture which surrounds the negro, i.e., makes the colored admire the whites and hence probably also the very light colored folk who can pass for white. Perhaps even the preference for fairness in girls stems from this source. The other forces, which gather momentum more slowly than the one just mentioned, press individuals toward approving those similar to themselves in race and in skin color.

As evidence for the race vector we offer the fact (*a*) that the older colored children strongly favored their colored classmates over the whites and *vice versa* for the whites, and (*b*) that appreciation by the negroes of the darker skin colors tended to increase in the upper grades. As evidence for the skin-color identification vector we present the following observations. (*a*) The light children, both male and female, in the grades above the second tended to have a less strong unfavorable bias, or a stronger favorable bias, toward the lighter colored negroes, both male and female, and also for whites as opposed to negroes, than the dark negro groups tended to have (Tables 20 and 21). The light negro boys at all grade levels even preferred white girls to negro girls. (*b*) The dark groups, both boy and girl, were inclined more frequently to express choices favorable to classmates who were dark than were the members of the other skin-color groups (Table 20). (*c*) Our white subjects, both boys and girls, tended to cast relatively more frequently favorable votes for light as opposed to medium-brown or dark classmates than the dark or medium-brown negro male or female judges did (Table 20). Thus, while it cannot be said that each pigmentation

group prefers its own kind, at least a tempering effect of the judges' own characteristics as to skin color is suggested.

We would remind the reader that the effects of the racial identification vector and the skin-color-type identification vector do not necessarily pull in the same direction. The most typical negro is medium brown and, hence, according to our hypothesis, should be strongly favored by the negro child as he comes to identify with his race and to understand what is typically negroid; but if a child is himself very light, for example, he is likely, we believe, to have his appreciation of the medium-brown type reduced somewhat by his disposition to put value upon the qualities he himself has. Hence we should expect, what we found, that even our eighth-grade colored subjects who were lightest in shade valued more their light classmates than the darker children did.

As we have just implied, we are of the opinion that the racial and skin-color identification vectors increase in force with age because the child's understanding and discrimination improves. The racial discrimination the negro child experiences, we believe, forces him into alliance with those of his own race. At the second-grade level, for instance, when probably none of the vectors we have mentioned is very strong, the colored children showed no very striking inclination to favor the classmates in any one skin-color group, albeit, at least among the girls, the light classmates were rather consistently, though very slightly, preferred to the very dark. The preference for the light negro girl, as opposed to the medium-brown and dark, was conspicuous, however, in the fourth and sixth grades, where the white-culture influence is doubtless strong but not so much opposed by the negro-identification vector as later. In the eighth grade, where the latter force may be expected to have considerable power, the preference-percentage-score means for the light girls drop significantly, although these girls are still preferred by both sexes to the very dark. The appreciation for the light boy, as opposed to the dark, seems to have been greatest in the fourth grade and to have decreased steadily thereafter. In the sixth and eighth grades the medium-brown boy classmates were esteemed by both sexes more than the light, and in the eighth grade the boys cast more favorable votes even for their dark boy classmates than for the very light. The eighth-grade girls, however, still favored the light boy over the dark, although slightly (Table 19).

Again our results point in the same direction as do Criswell's, in spite of the fact our analyses have not been entirely comparable to his.

Sex differences among our subjects as to pigment preferences seem fairly

consistent, though the differences are statistically not all that could be desired. The light, medium, and dark negro girls, for example, appear to have had a greater appreciation of light boys than the boys in the equivalent skin-color groups did (Table 20). Both sexes of negroes, on the other hand, tended to look with about equal favor on lightness in girls. White boys and girls, like the colored children, at least up to the eighth grade tended to express more choices favorable to the light negro girls over those of darker shades than they did relative to the light negro boys when these were paired with the medium-brown and dark (Table 19). In indicating the predilection of females for lightness, and for lightness in females, our results are in accord with those of Criswell (5).

Wondering whether cleavages along lines of national origin would occur among school children, as they do along racial lines, we carried out a study similar to the one just reported relative to the white-negro schools, in a school in a community in which an Italian vs. non-Italian schism was said to exist. The so-called "Italians" were mostly second- and third-generation Americans of Italian extraction and the non-Italian groups were Americans of primarily north-European stock but were not strictly homogeneous as to nationality nor strikingly different visibly from the Italians. Since our so-called non-Italian groups did contain some individuals whose immediate forebears came from nations not among the most popular with the American public (11), our results must be interpreted with this in mind.

Preference-percentage scores for the Italian and non-Italian groups were computed as for the racial groups which we described earlier. Table 22 gives the mean preference ratios for the two groups of judges in the various grades. Since for the non-Italians most of the group means are above .500, although, it is true, in no case very substantially, it seems reasonable to suspect that there was a tendency in the school for non-Italian children to prefer their non-Italian classmates. No consistent preference-score trends appear in the data for Italian children, however, except that all means for the second-grade pupils indicate a slight non-Italian preference, a tendency perhaps faintly expressive of the same mechanism which caused our young negro subjects to prefer whites. Since identification along racial and national lines is not very strong in the early years, it appears the values generated by identification tend to be rather weak and to be outweighed by the status valuation given a sub-group by the large cultural group.

In any case, the tendency for the children to prefer classmates belonging to their own national group, if indeed it existed, was distinctly less strong than the tendency on the part of our white and negro subjects to prefer classmates of their own race.

The only other consistent trend our nationality preference data show is a tendency, when the choices among the same children are compared, for the non-Italian girls to favor in their choices the non-Italian children more than the non-Italian boys. We wonder whether this trend, though the differences we mention are not statistically significant, is parallel to one uncovered in our race-preference data, namely, for the girls in the culturally favored group to prefer their own racial kind, especially when judging boys, more strongly than the boys do.

### C. SUMMARY

1. Our white subjects tended to prefer their white classmates to their negro ones from at least the second grade on, and increasingly so with increase in grade through at least the tenth.

2. The second-grade negro children studied, except those in the population in which whites and negroes were about equally represented, showed, on the average, little race preference but, if anything, favored the whites slightly. However, our negro subjects in the eighth grade, with the exception of the light boys when judging girls, uniformly expressed a preference for their negro classmates, and this trend continued in the high school. On the average, the proportion of choices made by the negro pupils which favored negroes increased steadily with grade to the tenth.

3. Among the white children in the lower grades the sex and race cleavages seem to have been of about the same magnitude; but whereas the distance between the sexes clearly decreased in the high school, the inter-racial distance appears to have increased, or at least not to have decreased from the highest point it reached in the grades.

4. Among the negroes in the lower grades, and especially among the negro girls, the sex cleavage seems to have been greater than the race, but at the high-school level the relation was reversed.

5. The white girls studied showed, on the average, a stronger preference for white classmates than the boys did, especially when judging boys, while among the negroes no consistent sex difference in degree of race preference was apparent except that when judging males, the negro boys expressed a stronger preference, on the average, for classmates of their own race than the girls did when judging girls.

6. The variability in the degree of race preference shown by the members of a school class appears among our subjects to have increased with grade to the sixth and possibly to the eighth.

7. The distributions of the race-preference-percentage scores of the eighth-grade and high-school children were J-shaped.

8. The white boys studied tended to show their preference for their own race more when judging girls than boys, whereas the reverse seems to have obtained in the case of the negro boys.

9. The whites in the school in which the white minority was large and the negro majority correspondingly small seem to have shown less preference for whites than did the whites in the other schools investigated, and in the same institution the negroes consistently exhibited a high average level of self preference. We do not know whether the finding can be attributed to majority-minority relationships existing in the white and negro populations represented, but it is similar to one reported by Criswell.

10. When the members of a given race were in a small minority, as opposed to a large majority, they tended to express a stronger preference for members of their own race who were of their own sex, while the reverse obtained in the case of the members of the opposite sex. Again we do not feel sure of the reliability or the significance of the trend.

11. The skin color of the judge appears to have influenced some the degree of his liking for classmates in the various skin-color groups, the judge having some inclination to favor those of his own kind.

12. The medium-brown negro, whether male or female, tended to be preferred to the dark by negroes of all shades as well as by whites.

13. The frequency with which grade-school negroes favored classmates light in skin color seems to have waned considerably by the eighth grade, the peak of the popularity of the lighter group having been reached by about the fourth grade. Consistent with this trend, the stock of the dark negro was lowest in the fourth grade and improved thereafter.

14. Our older negro subjects preferred, on the average, male negro classmates who were medium brown to those who were very light. The male negroes in the eighth grade, moreover, when judging males, even expressed a preference for their classmates who were dark over those who were very light, but the females still favored the light.

15. At practically all age levels the very light negro girl was favored over the dark, on the average, by both boys and girls; but the popularity of the light girl, as contrasted with the dark, was less in the eighth than in the fourth and sixth grades. The medium-brown and dark subjects in the eighth grade less frequently favored the light girl in their judgment than the medium-brown, but the lightest group of judges still exhibited the reverse tendency.

16. The negro girls among our subjects seem to have had a greater appreciation for lightness in males than the males had, but both sexes tended to value the lighter pigmentation in girls more than in boys.

17. The light negro more frequently favored whites, when choosing between whites and negroes, than the medium-brown or darker negroes did. In fact, the light negro boys at all grade levels tended to prefer white girls to negro girls.

18. Our data for the school in which a nationality cleavage along Italian-non-Italian lines was alleged to exist gave a faint reflection of this cleavage in that there seems to have been a very slight preference on the part of the non-Italian pupils for classmates falling in the non-Italian group. At the second-grade level, however, the Italian pupils also showed a slight preference, on the average, for their non-Italian classmates. Though the differences we have just described are not statistically significant, they do suggest a tendency similar to one revealed by our data concerned with inter-racial attitudes, namely, for children to value their own kind but for those in the culturally less favored group to lag in this learning because of the pressure of the values of the culturally favored group, with the result that the youngest among the unfavored may even express a preference for classmates in the culturally favored group.

19. The nationality cleavage studied, if indeed it existed, was of distinctly lesser magnitude than the racial cleavage investigated.

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## THE DEVELOPMENT OF THE SENSE OF TIME IN THE YOUNG CHILD\*

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### A. THE PROBLEM AND PROCEDURE

There are many scattered references in the literature to the development of the sense of time in the young child. However it appears that no systematic or detailed study has been undertaken to chart this development stage by stage.

The present study is based on a systematic compilation of the verbal expressions of time in the young child from the age when he first responds to the simplest words or phrases implying time, through the age when he freely uses the more common words indicating the various divisions of time and is able to tell time and talk about time in an adult fashion.

In order to obtain this material, two methods were used. The first was observation of children in the Guidance Nursery of the Yale Clinic of Child Development as they indulged in spontaneous or directed play. Children in the age groups thus observed ranged in age from 18 months to 48 months; in intelligence, from high average to very superior. All spontaneous verbalizations involving or even implying time expressions were recorded stenographically from behind a one-way-vision screen. Children were thus observed throughout the school season (September to June) during two consecutive school years.

The second method was to ask these same children a series of questions dealing chiefly with various aspects of the concept of time. Children were interviewed individually and were asked the entire series of questions at one sitting. At the younger age levels it was frequently necessary to allow the children to wander around the room as they were questioned. These questions were asked during the two consecutive school years when the free observations were being made. The questions reproduced herewith in Series A were asked of children aged 24, 30, 36, 42, 48 months—there being 6 children each questioned at 24 and 30 months; 20 children each at 36 and 42 months; and 15 children at 48 months. Repeatedly some one child was included in more than one age group.

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A second series of questions, Series *B*, was asked of 10 children at 5 years of age; and of 6 each at 6, 7 and 8 years of age.<sup>1</sup> All data gathered by these methods were then analyzed, summarized, and tabulated.

As will be evident, this study deals with verbalized manifestations of the sense of time. Apprehensions of time which the child was not able to express verbally were not considered. Questions in Series *A* and Series *B* are given in Table *A*.

TABLE *A*

Series <i>A</i>	Series <i>B</i>
1. What is your name?	1. What day is today?
2. How old are you?	2. Do you know the days of the week?
3. When is your next birthday?	3. What day do you like best?
How old will you be then?	4. What are you going to do tomorrow?
4. Where is your mummy?	5. What did you do yesterday?
Where is your daddy?	6. On what day does your father stay home all day?
5. What day is today?	7. What day comes after Sunday?
6. What days do you come to school?	8. Do you know what month this is?
7. What time do you come to school?	Do you know what day of the month it is?
8. Who comes for you?	Can you name the months?
When is she coming for you?	9. When is your next birthday?
9. When do you get up?	How old will you be?
When do you go to bed?	How old are you now?
10. When do you take your nap?	10. Do you know what season this is?
11. When do you have breakfast?	11. Do you know what year this is?
When do you have supper?	12. Is it morning or afternoon?
12. When does daddy come home?	When does afternoon begin?
13. What day does daddy stay home all day?	13. What time is it? (Showing watch)
14. What day comes after Sunday?	14. How many minutes in an hour?
Can you tell me the days of the week?	15. What time do you go to bed?
15. What are you going to do tomorrow?	What time do you get up?
16. What did you do yesterday?	What time do you have dinner?
17. What do you do on Sunday?	What time do you go to school?
18. What do you do in the winter?	16. How long do you stay in school?
What do you do in the summer?	17. What grade are you in?
What do you do in the spring?	18. When will you go to high school?
What do you do in the fall?	19. What do you play (or where do you go) in summer? in winter? in spring? in fall?
19. Is it morning or afternoon?	20. Can you tell me what the soldiers do?
When does afternoon begin?	Can you tell me what the sailors do?
20. How long does your nap last?	21. What does TIME mean?
21. How long do you stay in school?	
22. What do you do on Christmas Day?	
What do you do at Easter?	
What do you do at Hallowe'en?	
What do you do at Thanksgiving?	
23. What do the soldiers do?	
What do the sailors do?	
24. What time is it? (Showing watch)	

<sup>1</sup>Grateful acknowledgment is made to Miss Glenna Bullis who conducted these interviews.

## B. FINDINGS

Analysis of these verbal data indicates consistent trends in the development of the time sense in young children. The more common concepts of time seem to come in at the same relative age for most children, and in a rather definite order.

The usual order for the appearance of the most common time words, in spontaneous verbalization and in answer to questions, is given in tabular form. Following this, and to simplify presentation of the large body of data obtained, the child's verbalizations were considered under the following rubrics: general divisions of time, time of day and clock time, age concepts, past and future, and finally duration and order of events.

### 1. *Tabular Summaries*

The order in which the outstanding time words come into common spontaneous use as part of the child's everyday vocabulary is shown in Tables 1 and 2. Table 1 indicates the ages at which time words are first commonly used by children in our group. At any one age the child's "time" vocabulary usually consists of words listed at that age *plus* words already listed at earlier ages.

Table 2 presents the same material in such a way as to give a clear notion of the relative ages at which these various words come in; and also exhibits genetic changes which occur in the use of the following words with increased maturity of the speaker: day, night, time, season, year, minute, week, month, and morning.

Table 3 indicates at which ages more than 50 per cent of the cases were able to answer satisfactorily each of the questions presented in the questionnaire.

### 2. *General Divisions of Time*

a. *Morning or afternoon, Day, Time, Month, Season, Year.* To simplify the presentation of results, tabulations of responses to specific time questions have been grouped as much as possible. The first of these groupings (Table 4) gives the percentage of children answering correctly, or otherwise, questions dealing with:

Is it morning or afternoon?

What day is it?

What time is it?

What month is it?

How many minutes in an hour?

TABLE 1  
AGES AT WHICH "TIME" WORDS ARE FIRST USED SPONTANEOUSLY

21 mos.	<i>Present</i> —	Now	<i>Present</i> —	Now Today Aw day Dis day	<i>Present</i> —	This morning This afternoon Last night Last week In the wintertime Some day One day Tomorrow After awhile After juice Pretty soon
24 mos.	<i>Future</i> —	Gonna In a minute	<i>Future</i> —	30 mos.	<i>Future</i> —	Birthday Christmas day Sunday morning This week This winter (Days of week)
<i>General</i> —						
What time?						
It's time						
This time						
I'm late						
<i>Clock time</i> —In 5 minutes						
Five o'clock						
Eleven-thirty						
(Pretense of telling time)						
Lunch time						
Juice time						
Time for music						
Night time						
This noon						
<i>Present</i> —	<i>Present</i> —	This minute Right now For a long time	<i>Present</i> —		<i>Clock time</i> —	Three hours Half pas six Our time is over Time to get up Early in the morning Noontime
<i>Past</i> —	<i>Past</i> —	For years Last Sunday One time A minute ago	<i>Past</i> —		<i>Present</i> —	My turn now Good morning For a little while Every morning



TABLE 2  
GENETIC GRADATIONS IN USE OF "TIME" WORDS

Age	Day	Night	Time	Season—Year	Minute	Week—Month	Morning
24 mos.	Dis day Today Aw day				In a minute*		
30 mos.	One day Some day Birthday Christmas day Sunday, etc.	Las' night	Winter-time**	This winter:**		This week Last week	This morning Sunday morning
36 mos.	Yesterday Other day Every day Holiday School day Some day The last day In three days	Tonight At night Night-time Other night One night Tomorrow night Middle of the night	Lunchtime Puzzle time Night-time This time Next time Every time Some time Time! What time It's time When it's time Time for music A long time All the time Once	Summer Spring Last year Next year**	In 5 minutes	For 2 weeks	
42 mos.		All night Night—day	Sometimes One time Almost time Meantime For a long time Is it time? Our time is over For some time Time to get up Springtime Noontime Last time	For years (past) For years (future) Every year	This minute A minute ago	A whole week	In the morning Tomorrow morning
48 mos.	Every day Another day Once a day				Few more minutes	Next week Some other week Next month For a month In a month	Early in the morning
60 mos.			Do we have time?				

\*Perhaps early use of minute is imposed from without

\*\*Used inaccurately at first

TABLE 3  
AGES AT WHICH 50 PER CENT OF CASES ANSWERED CORRECTLY QUESTIONS ABOUT TIME

---

*2½ years*

Where is mummy?  
Where is daddy?  
Who comes for you?

*3 years*

What is your name?  
How old are you?  
What will you do tomorrow?  
When do you go to bed?  
What do you do at Christmas?  
What do you do in winter?

*3½ years*

When do you take your nap?  
What do you do in summer?  
What do you do at Easter?

*4 years*

When is your next birthday?  
When do you get up?  
When do you have breakfast?  
When do you have supper?  
When does daddy come home?  
What did you do yesterday?  
What do you do on Sunday?  
Is it AM or PM?  
When does PM begin?  
What do you do at Hallowe'en?

*5 years*

How old next birthday?  
What day is today?  
Name days of week.  
What day does daddy stay home all day?  
What day comes after Sunday?  
What day do you like best?

*6 years*

What time do you go to school?  
What do you do in Spring?  
What do you do in Fall?  
How long do you stay in school?  
What grade are you in?

*7 years*

What time is it?  
What season is it?  
What month is it?  
How many minutes in an hour?

*8 years*

What day of month is it?  
Name the months.  
What year is it?  
What does Time mean?

---

TABLE 4  
PERCENTAGE OF CHILDREN ANSWERING CORRECTLY QUESTIONS DEALING WITH DAY,  
HOUR, MONTH, SEASON, YEAR

	2½ yrs.	3 yrs.	3½ yrs.	4 yrs.	5 yrs.	6 yrs.	7 yrs.	8 yrs.
<i>Is it AM or PM?</i>								
No answer	90%	30%	55%	7%	0	0	0	0
Wrong	0	30%	10%	13%	10%	16%	0	0
Right	0	40%	15%	71%	90%	84%	100%	100%
<i>What Day is It?</i>								
"I don't know"	10	15	50	45	0	16	0	0
Names a day	30	30	30	45	80	64	100	100
Incorrect	20	25	25	20	10	16	16	0
Correct	10	5	5	26	70	48	84	100
<i>What Time is It?</i>								
No answer	100	40	30	26	0	16	0	0
"No" or "I don't know"	0	10	45	40	80	48	0	0
Tells wrong	0	30	25	26	20	0	0	0
Correct	0	0	0	7	0	32	100	100
Hour only	0	0	0	7	0	32	16	0
More specific	0	0	0	0	0	0	84	100
<i>What Month is It?</i>								
"No"								
Wrong					30	50	16	16
Right					0	0	0	16
					30	33	84	66
<i>How Many Minutes in an Hour?</i>								
No answer					30	33	0	0
"No" or "I don't know"					70	48	0	16
Inadequate or wrong					0	16	49	16
Correct					0	0	50	66
<i>What Season is It?</i>								
No answer					20	50	0	0
"No"					30	33	50	16
"I don't know"					10	0	0	16
Wrong					30	0	0	0
Correct					0	16	50	50
<i>What Year is It?</i>								
No answer					20	16	0	0
"No"					30	32	16	16
Inadequate					20	16	16	0
Wrong					0	16	33	0
Correct					30	16	33	84
<i>What Day of the Month?</i>								
No answer					70	80	50	16
"No"					30	0	16	0
Inadequate					0	16	16	0
Wrong					0	0	0	16
Adequate					0	0	0	66
<i>What Does Time Mean?</i>								
No answer					20	50	33	16
"No" or "I don't know"					50	50	50	33
Inadequate					10	0	0	0
Adequate					20	0	16	50

What season is it?

What year is it?

What day of the month is it?

What does "Time" mean?

As the table indicates, morning or afternoon is the first concept to be attained, 50 per cent of the children answering this question correctly by 4 years. By 5 years over half the children can tell what day it is; by 7 years, all can tell what time it is.

By 7 years the majority of children can tell what month it is, how many minutes in an hour, what season it is. Not till 8 years can they tell what year it is, what day of the month, what "Time" means.

The table further suggests that the child's earliest response, when a question is entirely too difficult for him to answer, is to keep silent. At a slightly older age he will answer "No" or "I don't know." Next he may give a more detailed verbal response which may be pertinent to the question asked but which is not an adequate answer. Next he will give a wrong answer; and finally a correct answer.

*b. Days of the Week, Months of the Year.* Closely related to the attainment of the preceding concepts is the ability to name the days of the week and the months of the year. The days are named correctly by over half the children as early as 5 years; the months not until 8 years.

*Days of the week:* Wednesday and Thursday appear to be the most difficult days for children to name. Of all 13 times when children in this group try to name days of the week but leave out one or more days,—Monday is included by 10, Friday by 10, Sunday by 9, Saturday by 8, Tuesday by 7, Wednesday by 5, and Thursday by 5.

However when the question, "*What day do you like best?*" was asked (a question answered adequately by over half the children by 5 years of age), "Sunday" was chosen most frequently, "Saturday" next most frequently, while "Saturday or Sunday" was the third most popular answer.

*Months of the year:* September and August seem to be the most difficult months to name. Of all 15 times when children attempt to name the months but leave out one or more,—February is included 10 times, January 9, October 8, June 8, April 7, July 7, May 6, December 6, November 5, August 4, September 2.

*c. Holidays and Seasons.* Questions about *what do we do* at the different holidays and during the different seasons, are answered correctly by half the children as follows. There is a tendency for the specific holidays to be known *before* the seasons.

Christmas, at 3 years.  
 Easter, at 3½ years.  
 Hallowe'en at 4 years.  
 Thanksgiving not before 5 years.

Winter, by 3 years.  
 Summer by 3½ years.  
 Spring, by 5 years.  
 Fall, by 6 years.

There is little uniformity to the responses except in the case of Christmas and Easter, in which cases we find many children making the same responses. In response to *What do you do at Christmas: Santa Klaus* is the predominant interest at 2½ years; he shares with *presents* at 3 and 3½; *presents* definitely predominate at 4 years. *Tree* is about equally important at all ages, rivalling other interests at 3 years.

TABLE 5  
 SPONTANEOUS USE OF PHRASES INDICATING TIMES OF DAY

Age	Word or phrase
24 months	Today
30 months	Last night Last week Tomorrow (36 months) This afternoon (48 months) This morning (48 months) Sunday morning Tomorrow morning This week This winter (36 months) Last week
36 months	Yesterday (48 months) This noon Summer (42 months) Spring (60 months) Last year Tonight Tomorrow night Lunch time Juice time Night time (48 months) In the middle of the night
42 months	In the morning (48 months) All night A whole week
48 months	Early in the morning (60 months) Springtime Noontime Next year Next month

In response to *What do you do at Easter: Eggs* predominate in interest at all ages though the *bunny* rivals eggs at  $3\frac{1}{2}$  years.

### 3. Time of Day and Clock Time

a. *Spontaneous use of phrases indicating times of day.* The preceding table (Table 5) indicates the ages, for this group of cases, when the more common phrases indicating times of day and related time divisions come into common spontaneous use. This material is included in previous tables but is re-presented here to bring it into close comparison with responses of the

TABLE 6  
PERCENTAGE OF CASES WHO ANSWER QUESTIONS ABOUT EVENTS TAKING PLACE AT CERTAIN TIMES OF DAY

	2½ yrs.	3 yrs.	3½ yrs.	4 yrs.	5 yrs.	6 yrs.	7 yrs.	8 yrs.
<i>When Go to Bed</i>								
No answer	60%	20%	5%	0	0	0	0	0
"I don't know"	0	10	15	13	10	16	0	0
Incorrect time	0	10	20	0	0	0	0	0
Adequate activity	0	30	25	20	0	0	0	0
Correct time	0	20	35	26	90	84	100	100
<i>When Have Supper</i>								
No answer	70	35	30	0	0	16	0	0
Pertinent	30	10	10	0	10	16	16	0
Incorrect time	0	15	10	20	0	0	0	0
Adequate activity	0	10	25	64	10	0	0	0
Correct time	0	20	15	7	40	66	84	100
<i>When Get Up</i>								
No answer	50	10	0	0	0	0	0	0
"I don't know"	10	5	15	20	30	0	0	0
Not pertinent	0	5	15	13	10	0	0	0
Incorrect time	0	30	50	13	10	16	0	0
Adequate activity	0	10	5	32	30	16	0	0
Correct time	0	20	10	20	20	66	66	100
<i>When Go to School</i>								
No answer	70	20	0	0	0	0	0	0
"I don't know"	0	20	45	39	10	16	0	0
Inadequate	20	5	5	7	30	0	0	0
Incorrect time	0	35	20	26	20	16	0	0
Adequate activity	0	10	10	20	0	16	0	0
Correct time	0	0	0	7	30	50	100	100
<i>When Does PM Begin</i>								
No answer	100	55	55	20	10	0	0	0
"I don't know"	0	15	20	0	10	0	0	0
Incorrect time	0	0	10	20	0	0	0	0
Accurate words	0	10	15	52	40	50	50	16
"After lunch" or								
"After dinner"	0	5	0	26	30	50	50	16
"After nap"	0	0	15	20	10	0	0	0
Correct time	0	0	0	0	40	33	50	84

children to *direct questions* dealing with this same aspect of the notion of time, and to bring out the fact that many of these words are used spontaneously before the child can answer simple questions about these times. Figures in parentheses indicate age when questions about these words are answered successfully by half the cases.

*b. Events taking place at different times of day.* Tabulation of the responses to questions about the times when different daily activities take place suggests that children can first tell correctly what time they go to bed; then when they have supper; then when they get up; then when they go to school; and finally, when afternoon begins. As Table 6 indicates, the majority of children can tell what time they go to bed when they are 5 years old; answers to the other questions come in, decreasingly, by 6 years of age.

The table further suggests that the child's earliest responses, when such questions are too difficult for him, is to give no answer. When a little older he will customarily say, "*I don't know.*" Next he may give an answer which is not pertinent to the question. Next he may give an answer in terms of clock time, but an incorrect answer. Next he answers in terms of some activity which describes correctly the time when the event takes place but not in terms of clock time. Finally he gives the correct time.

*c. Clock time.* Though the majority of children observed in this study could not tell time until they were seven years of age, there are many forerunners to this ability, noted at earlier ages, as Table 7 indicates.

#### 4. Tells Age

Table 8 gives the percentages of children at each age who can tell how old they are, when their next birthday will be, and how old they will be at the time of their next birthday. As the table indicates, more than half the children can tell their age correctly by the time they are three years old. By 4 years they can tell when their next birthday will occur and by 5, they can tell how old they will be at the time of their next birthday.

Detailed analysis of responses indicates that in response to the question, "How old are you?" the majority at three years say "three years" or "three years old." The number by three and a half years who add "years" or "years old" has decreased to less than half; and by five years only one child adds "years old" to his answer, nearly all answering merely "five."

The same trend is seen in regard to answers to the question of how old they will be at their next birthday. At three and a half years nearly half the children add "years" or "years old" to their answer while by four years only one child adds "years old" to his answer.

TABLE 7

---

"CLOCK-TIME"

---

*18-21 months*

Children respond to "In a minute," "now," "after juice."

They say, "Now." They are for the most part creatures of the moment.

*24 months*

Children respond to "Soon," "pretty soon," "wait," "when it's time." They are beginning to be able to wait for things.

They say, "In a minute."

Asked what the clock says, they respond: "Meow," "Thirty pounds," etc.

Nearly half the 2-year-olds tested by Holbrook recognized as a watch a drawing consisting only of a circle with two hands and short straight marks around the circumference.

*30 months*

Children respond to "It's time to," "when he's finished."

They say, "After juice," "after awhile," "pretty soon."

Child puts car in its locker for "a baby vile" (a little while).

*36 months*

There is spontaneous use of clock times, or durations, but very inaccurate. Child pretends to phone: "Hello, Daddy. It's about three o'clock. Did you say?

It's eleven-thirty. That's when you're suppose to come for me." Or, "You have to be off there in five minutes." Or, "I slept late, too. Till ten."

Common phrases are: "Almost juice-time," "lunch time," "time for music," "what time?," "next time," "when it's time," "in five minutes."

Pretense of telling time. Looks at watch and says, "Two eight," or "pas' o'clock."

Many children can answer the question, "When do you go to bed?" in descriptive words, but cannot give the clock time.

*42 months*

Common phrases are: "A minute ago," "this minute," "come right here this minute."

*48 months*

Common phrases are: "Wait a few more minutes," "Just a minute till . . .," "Time to get up."

Spontaneous use of clock times, but inaccurate. "Our time is over. Haf pas' six." Again, as at 3 years, pretense of telling time.

Can tell, in terms of activity, when they have supper.

Can tell, in terms of activity, when they get up.

Can tell, in terms of activity ("after lunch"), when afternoon begins.

Can tell whether it is morning or afternoon.

*5 years*

Most can tell at what hour they go to bed.

Can tell correctly what day it is.

None can tell correctly what hour it is.

*6 years*

Can tell at what hour they have supper.

Can tell what hour they get up.

Can tell at what hour they go to school.

Only one-third could tell time by the clock and these could give only the hour, not the minute.

*7 years*

Can tell at what hour afternoon begins.

All could tell time by the clock. Nearly all could tell the minute as well as the hour. Half could tell how many minutes in an hour.

---

TABLE 8  
PERCENTAGE OF CASES ANSWERING CORRECTLY QUESTIONS ABOUT AGE AND BIRTHDAYS

	2½ yrs.	3 yrs.	3½ yrs.	4 yrs.	5 yrs.	6 yrs.	7 yrs.	8 yrs.
<i>How Old Are You?</i>								
No answer	30%	10%	0	0	0	0		
"I don't know"	10	5	5	13	0	0		
Inaccurate	20	20	0	0	20	0		
Accurate	0	65	95	84	80	100		
<i>When Next Birthday</i>								
No answer	30	5	0	0	0	16		
"I don't know"	10	10	15	20	30	0		
Inadequate or wrong	50	0	45	27	0	0		
Refers to in past	0	30	20	0	0	0		
Refers to in future	0	30	35	52	70	66	100	100
Accurate	0	5	20	52	70	66	100	100
Month		5	20	39	30	33	16	0
Month + day					40	33	84	84
Month + day + year								16
<i>How Old Will You Be</i>								
No answer	70	30	15	0				
"I don't know"	0	10	10	32				
Incorrect	0	15	20	20	20			
Correct	0	20	35	45	80	100	100	100

### 5. Past, Present and Future

a. *In spontaneous verbalization.* Words indicating present time come in first, developmentally; then words indicating future time; and finally words denoting past time. This is evident both in the spontaneous verbalization of children and in their answers to questions. So far as volume of time words goes, Table 9 shows that from 18 through 30 months by far the greater percentage of time words used deal with the present, a few with the future, almost none with the past. With increasing age, use of the present tense decreases consistently and markedly. Use of the future increases slightly. The past, which does not appear till 24 months, increases slightly.

By 36 months there are nearly as many words dealing with the future as with the present. By 42 months about one-third of the time verbalizations deal with the present, one-third with the future, one-third with the past. Many different words and phrases indicating past time come in at this age for the first time.

So far as the number of *different* words dealing with each of these aspects of time, Table 1 has already clearly shown this same trend; that words dealing with the present come in first; then words dealing with the future and then words dealing with the past. The child first uses the word "today"; later, "tomorrow"; finally "yesterday."

TABLE 9  
RELATIVE NUMBER OF STATEMENTS DEALING WITH PAST, PRESENT AND FUTURE IN  
SPONTANEOUS NURSERY SCHOOL CONVERSATIONS

Age	Present	Future	Past
18 months	100%		
21 months	87%	13%	
24 months	64%	26%	10%
30 months	59%	25%	14%
36 months	41%	36%	21%
42 months	34%	33%	32%
48 months	47%	33%	19%

TABLE 10  
SPONTANEOUS USE OF PAST, PRESENT, AND FUTURE TENSES

Responds to present "now."	<i>18 months</i>
Responds to "in a minute."	<i>21 months</i>
Verbalizes the present "now."	<i>24 months</i>
Responds to "soon," "wait," "pretty soon."	
Responds to "after juice," "when," "when it's time."	
Verbalizes present and future time words as: "today," "now," and "gonna," "in a minute." Much use of the present participle "gonna."	
Uses past tense of verb "stayed home," "played" though often inaccurately.	<i>30 months</i>
Not only present and future but also past "time" words are used. The past is usually indicated by "last night" or maybe by "this winter." There are more different words to indicate future events: "one day" is very commonly used for any future time.	
"Tomorrow" is used but not "yesterday."	
The past goes as far back as "last week."	
Both past and future verbs are used, future more than past. Past tense may be inaccurate.	<i>36 months</i>
Present, future and past time words all used in abundance. "Yesterday" is now used as well as "tomorrow."	
Much greater variety of future than of past words. However it is noteworthy that "future" expressions are <i>general</i> as "later," "some day," "next time" or include only so many minutes or days, whereas "past" expressions include specific items such as "last night," "last week" and "last year." (This suggests greater maturity of the notion of the future).	
Both past and future verbs are used, often accurately. Phrases expressing duration are coming in.	
"Next year" is used as a blanket phrase for the future.	<i>42 months</i>
Very similar to 36 months. More different words and phrases to express the past come in. Also phrases to express duration are frequent.	
Past tense of verbs is usually accurate.	
But there comes in here a confusion of times, evident in such statements as "I'm not going to take a nap yesterday."	<i>48 months</i>
No special new trends as to past, present and future except that the confusion of times noted at 42 months drops out. The three tenses are used about evenly, and tenses are usually accurate.	

A genetic summary, by ages, of the relative spontaneous use of past, present, and future tenses is given in Table 10.

*b. In answers to questions.* Not only does the word "tomorrow" come in, in spontaneous verbalization before use of the word "yesterday," but also the child in answer to questions is able to tell what he will do tomorrow before he is able to tell what he did yesterday. The child is also able to tell what he does on Sunday before he is able to tell what he did yesterday. The average child in this group could tell what he would do tomorrow when he was 3 years old, "play" being the most common answer. He could not tell what he had done yesterday until he was 4 years old, "played" being the most common answer, and "stayed home" or "went to school" also occurring frequently. At some time between the ages of 3 and 4 years the child becomes able to tell what he does on Sunday.

*c. In general.* In general it can be said that "tomorrow" and other future phrases and tenses come in definitely before use of "yesterday," of phrases denoting the past, and of marked spontaneous use of the past tense.

However, so far as specific time phrases are concerned, we do get "last night" (used at first to denote any time past and not just actually last night) used before "tomorrow night"; "last year" before "next year"; "last week" before "next week." "Some day," "some time," and "Friday" are used before "some days," "some times," and "Fridays."

In answering questions about events happening at different times of day, children know time of going to bed first, then time that they have supper, then time that they get up, then breakfast time, and finally school time.

It may be further noted that use of "after" precedes use of "before"; and that "late" precedes "early."

## 6. Duration and Order of Events

*a. Duration.* It was observed that specific single times precede time words and phrases implying duration. This is true both of spontaneous verbalization and of answers to questions. Though single time words occur as early as 21 months, and are quite prevalent by 30 months, expressions of duration do not generally appear until 36 months when children use such durational phrases as: "All the time," "all day," "in the meantime," "for two weeks," "for three days," "generally." By 42 months durational phrases involve longer durations: "never," "for years." These expressions are vague and general however, rather than accurate, when they first appear. "In five minutes" as used at 36 months means little more than "pretty soon."

Very frequently specific single times come in before similar words or phrases which denote duration. Thus:

"Some day" precedes "some days" which precedes "every day."

"This time" precedes "every time."

"Some time" precedes "some times."

"Friday" precedes "On Fridays."

"This week" precedes "for two weeks."

"Last year" precedes "for years."

"In a minute" precedes "few more minutes."

"Some time" precedes "all the time."

"This morning" precedes "every morning."

In response to questions about duration ("How long do you stay in school?") there appears a definite developmental sequence, as follows:

A description in terms of activity: "Well, we take a rest and then our mothers come" (4 years).<sup>2</sup>

The word "until" followed by an activity: "Until lunchtime" (4 years).

The word "until" followed by an hour: "Until twelve" (5-6 years).

A specific number of hours: "Four hours and a half" (7 years).

This indicates that the instruction to a child to do something at a specific hour is useful long before an instruction to do something "in an hour" or "for an hour."

*Speed*: No questions were asked dealing with speed of movement, and few spontaneous verbalizations were overheard which dealt with speed. At 30 months one child was heard to say, "Leh go fas', quite fas'. Come on as fas' as you can." Another at 36 months said, "I'm fast as Johnny cause I'm much hurrier awful fast." Another at 42 months verbalized, "I can't wait. Hurry."

*b. Order of Events*. A rather complicated use of time words and phrases to express order of events comes in at a comparatively early age. Simple ideas of sequence are expressed as early as two years, and by two and a half years many different kinds of phrases and expressions are used to indicate sequence. Table 11 gives genetic gradations of the ability to express sequence, as observed from 18 months to four years.

## C. DISCUSSION

### 1. *Levels in Attaining Concepts of Time*

It should be borne in mind that complete mastery of any one time concept is not acquired all at once. There are several different levels of attainment,

<sup>2</sup>These ages are merely suggestive. Data were inadequate to make a definite age assignment for this sequence.

TABLE 11  
DIFFERENT WAYS OF EXPRESSING SEQUENCE

Expressions of sequence
<p><i>18-21 months</i></p> <p>No expressions of sequence.</p>
<p><i>24 months</i></p> <p><i>Object signals activity:</i> Children go to the table when they see juice put on.  <i>Future event:</i> "See you later"; "Mummy coming back soon."  <i>Simple sequence:</i> "Now 'at one."</p>
<p><i>30 months</i></p> <p><i>Future event:</i> "I'm gonna do some paint."  <i>Completion:</i> "I'm all finished with my beads." "I'm ready for some more."  <i>Non-completion:</i> "I'm not through yet."  <i>Sequence poorly expressed:</i> "I'm doing that one and now he is doing it."  <i>Sequence with "after":</i> "After awhile we'll all be finished and have tomato juice."  <i>"First":</i> "No, no, Solveig wants to go first."  <i>"First . . . then":</i> "First I go down; then you push me down."  <i>"Turn" + sequence:</i> "Now my turn. Going up after Rosemary on the jungle gym."  <i>"Not until":</i> "But they don't go to school till they're grown up."  <i>Result of action:</i> "Don't open that window. I'll catch cold."  <i>Simultaneous action:</i> "Helped Betty. Washed dishes. Mommy west."</p>
<p><i>36 months</i></p> <p><i>Future event:</i> "Next year I'm going to get skates with three runners."  <i>Noun-time:</i> "It's puzzle-time"; "We're going to have juice-time."  <i>Incorrect sequence:</i> "I was here after I was up. If I get dressed I was here."  <i>"I" afraid it will rain when I go in the house when I want to get my rubbers."</i>  <i>Good sequence:</i> "First you push the button and then up, up, up." "Next one will be me and after me" (to be four years old) "comes Nancy."  <i>Spaced sequence:</i> "I won't talk on Wednesday and Friday but on Monday when her hair grows I'll talk to her."  <i>"Time":</i> "Time for music, time for music, time."  <i>Result of action:</i> "If you went in there you get all wet."  <i>"As soon as":</i> "I'll show you as soon as I get my suit off."  <i>When phrase:</i> "I was in the little room when I was a baby." "When I get finished with these I'm gonna paint."  <i>"If . . .":</i> "If I could climb up on there I could see the stars."</p>
<p><i>42 months</i></p> <p><i>Future event:</i> "Bimeby I'm going to paint. Bimeby. We not finished yet."  <i>Confused future:</i> "Some other day tomorrow. I'm not coming cause tomorrow I have to roller skate or in the army."  <i>Precedence:</i> "You see, I had it first."  <i>Sequence, forward:</i> "Wait till Johnny gets through. Then you could have a ride with Mary."  <i>Sequence, backward:</i> "Just before we went to school I saw a big scraper." "Before we put any toys in it we have to put a candle in and light it."  <i>Sequence of days:</i> "I'm going to Sunday School. Next day I'm going to play school."  <i>When phrase:</i> "I'm going to do a trick that John can't do. When he's older he can do it. I older than him."  <i>Habitual action:</i> "My daddy comes to school on Fridays."  <i>Duration:</i> "We are all going to Detroit today. We are going to stay free weeks."  <i>Increase:</i> "Every day I come I'm stronger. Today I can carry three."  <i>Coincident actions:</i> "Let's play the bictrola while we sail boats."  <i>Result:</i> "When Mary comes down there will be several girls."  <i>Clocktime:</i> "Hello, Daddy, can you meet me at 5 o'clock?" "Daddy it's 11:30. That's when you're suppose to come for me."</p>

48 months

*Exact duration:* "I'm going to be finished in ten minutes."

*Potential sequence:* "I could take this home with me and then bring it back."

*When phrase in past:* "I remember when I was a little boy I used to sit on this train and ride it."

*Simultaneous:* "When we came to school it was raining."

*Habitual:* "He never gets in the corners, does he?"

chiefly it appears as follows. First the child is able to respond suitably to a time word; next he is able to use it himself in spontaneous conversation; and lastly he is able to answer correctly questions dealing with the concept. Thus a child responds, by waiting, to the phrase "Pretty soon," at 18 months; he uses the phrase himself spontaneously at 24 months; and at 42 months he can answer the question, "When is mummy coming for you?" by the answer, "She'll come pretty soon."

## 2. Use of the Specific Preceding Use of the General

The preceding sections have provided many examples of the fact that the child can comprehend and use expressions denoting the specific before he can comprehend and use expressions denoting the general. Table 2 presents many examples of this as it reflects the development of the use of such words as "time," "day," "night," etc. Reference to this table shows that "time" is used in such specific contexts as "wintertime," "lunchtime," "puzzletime" when it first appears. Only much later do the phrases, "When it's time," "Our time is over," "Do we have time" come in. Similarly "Dis day," "today," "Saturday" appear long before phrases such as "Other day," "In three days," "Every day." "In a minute," "In five minutes," precede "Few more minutes."

Similarly, the child can first name one of the months in relation to the specific event of his birthday; later he can name all or some of the months in recitative fashion; later he knows the word "month."

Giving a time answer in terms of some activity definitely precedes the ability to give a more generalized clock-time answer, for nearly every time question that was asked. This held true for the following questions: When do you go to bed; when do you have supper; when do you get up; when do you go to school; when does afternoon begin; when do you have your nap; when do you have your breakfast; and when do they come to take you home from school.

Furthermore, within the activity answers, it is frequently possible to determine a definite genetic gradation, certain types of activity answers typically coming in before others. "After . . ." seems to come first; then

"when . . . ," and finally, "before. . . ." Here, too, the specific seems to come in before the general. Thus in answer to "When do they come to take you home from school?" the child answers, "After my lunch" before he answers, "When we've had enough play" or "When I'm all ready for go."

Some words are first used for a certain situation before they have any meaning apart from it. "Wait for me" is meaningful in relation to an out-for-a-walk situation before the word "wait" alone is useful. It cannot be generalized at once. The first injunctions to wait for certain things to occur do not start with the word "wait," but with "In a minute."

### 3. *Inaccuracies*

There are many, many inaccuracies which come in as the child's time-sense develops. They suggest the complexity of the problem which confronts him and the difficulty he finds in acquiring mastery over the different divisions of time and their relations to each other. Wrong use of tenses is a very common error. Use of time-phrases or of actual clock-time expressions in an inaccurate or inappropriate context is very frequent.

An overall view of the kinds of inaccuracies commonly met with is afforded in Table 12 which presents selected representative inaccuracies overheard

TABLE 12  
TYPICALLY INACCURATE USES OF TIME WORDS AND PHRASES

Age	Remark
25 months	All gone juice.
26 months	An she died an' died an' died. Membah?
26 months	I go to church tomorning.
27 months	Wake up, Mummy. It's pas' o'clock.
28 months	After we finish the juice that be we.
30 months	May I go in de big boat to-week? (Meaning, next week).
30 months	I had a bath tomorrow, and I even washed my ears.
32 months	That's what we usual do.
34 months	I used to have buttons on my overalls when I was just a tiny girl when I was born. I was born last night and I used to sing, "Mer rily on Christmas Day."
36 months	Next Christmas when I have my birthday.
39 months	I was here after I was up. If I get dressed I was here.
42 months	I'm going to ask her we're already here.
42 months	Will we do it yesterday?
42 months	I'm not going to take a nap yesterday.
43 months	My baby is ten weeks; no ten years.
44 months	Nobody's going to put it back for years.
46 months	He's gonna have his birthday yesterday. Tomorrow-yesterday if h feels better.
47 months	My birthday's gonna be New England.
48 months	She goes to kindergarten high school. It is called high school kinder garten.

in spontaneous conversation of our subjects in chronological order of their occurrence.

In replying to questions about time, both those which can and those which cannot be appropriately answered by the name of a day, a few children (15 per cent at 3 years) perseveratively repeat the name of some one day in answer to several questions. This does not occur conspicuously after three years, and it is noteworthy that it is probably as much of a personality as an age factor since most of the children who exhibit it are also children who perseveratively respond to other questions with repetition of some one number, usually an inappropriate number.

Perseverative and inappropriate repetition of some one clock time (most commonly six o'clock or eight o'clock) in answer to many questions occurs in 35 per cent of the 3-year-olds; and in 15 per cent of the  $3\frac{1}{2}$  and of the 4-year-olds. In any one child this behavior occurs at only one age level, suggesting that it has for any one child a definite place in the developmental sequence.

Occasionally, in response to questions about time, we get a response in terms of some obviously inappropriate number such as "fifty-nine," or "eight-nine-four." This kind of response occurs most conspicuously at 3 years of age, when 25 per cent of the children make this kind of answer. Those who make it, do so repeatedly. Thus one child answers "eight-nine-four" to eight of the 24 questions asked him at 3 years; one answers "sixty-nine" to four questions and "sixty" to four others. A definite personality factor seems to be involved here, for the children who make this kind of response are the same children who use a day name or a clock-time perseveratively and inappropriately.

### 5. *Individual Differences*

More and more do we realize the tremendous individual differences which exist from child to child as regards orientation in time and space. There are children who very quickly develop both time and space concepts and who almost from the beginning seem to be adequately oriented in time and space. In other children these concepts develop late and inadequately. In some children time orientation may be adequate but not space orientation, and in others just the opposite. Some children, however, are so poorly oriented as to both time and space that we believe this lack of orientation may constitute a genuine handicap which has not hitherto been given sufficient consideration.

These differences are not merely due to differences in intelligence. Of

TABLE 13  
INDIVIDUAL DIFFERENCES IN UNDERSTANDING OF TIME CONCEPTS

30 months level		Child J.A. Number correct: 6	
Child R.S. Number correct: 0			
1. Name:	Smiles	1. Name:	Jean Elizabeth
2. How old:	Turns away	2. How old:	Free year old
3. Next birthday:	No	4. Where's mummy:	She's home
How old then:	No	5. Day today:	He went at the office
		8. Who comes for you:	I don't know
		9. Time get up:	Mommy
		10. When take your nap:	I don't know
		22. Do at Christmas:	I don't know
		Do at Easter:	Santa Kaus comes
			I don't know what I do at Easter time
36 months level		Child B.M.: 16	
Child M.R. Number correct: 4		1. Name:	Betsy Idk Masters
1. Name:	Michael	2. How old:	Two and a half
3. Next birthday:	Home	3. Next birthday:	January
4. Where's mummy:	Gone away	How old:	Three
Where's daddy:	Gone away too	4. Where's mummy:	Home
5. Day today:	Eight-nine	5. Day today:	At work
6. Days to school:	Eight-nine	6. Days to school:	Tuesday
8. Comes for you:	Daddy	7. Time to school:	Mondays and Fridays
When:	Eight-nine-four	8. Who comes for you:	When the car comes
9. Time get up:	Eight-nine-four		Justine does take care of me
10. Take your nap:	Eight-nine-four		
11. Have breakfast:	Eight-nine-four		
12. Daddy come home:	Eight-nine-four		
18. Do in winter:	Idk		
Do in summer:	Eat No.		
22. Do at Christmas:	Idk		
23. Soldiers do:	March all around		
Sailors do:	Idk		
			(Whispers) Seven o'clock
			Six o'clock. You don't get up when the alarm clock stops ringing
			Six o'clock too

TABLE 13 (*continued*)

11. Have breakfast:	Seven o'clock
Have supper:	Six o'clock
12. Daddy come home:	Tonight
13. Daddy stay home:	Monday
14. Day after Sunday:	Tuesday
15. Do tomorrow:	I'm gonna stay over to my house tomorrow
16. Do yesterday:	(She holds her feet and looks embarrassed)
17. Do on Sunday:	I play in my room
18. Do in winter:	You go swimming in the winter
Do in summer:	You swim in the summer too
Do in spring:	No
Do in fall:	No
19. AM or PM	Morning
Afternoon begin:	No
20. Long nap last:	Seven o'clock
21. Long stay in school:	Three o'clock till Justine comes
22. Do on Christmas:	Everything
23. Soldiers do:	They march
Sailors do:	No
24. Time is it:	Seven o'clock

TABLE 13 (continued)

42 months level	
<i>Child E.S. Number correct: 12</i>	<i>Child D.J. Number correct: 32</i>
1. Name: Don't tell me	1. Name: Dexter Jackson, Jr.
2. Age: Don't tell me	2. Age: Three in July. Yeah
3. Birthday: Free years After Dorothy's birthday it's ours	3. Next birthday: Oh next July
How old: I'll be thirty-eight	4. How old: Four
4. Where's mummy: She's at home	Where's mummy: Home
6. Days to school: Daddy's at the hospital	Oh in the Air Field
7. Time to school: Don't tell me	That's in New Jersey
8. Comes for you: Sometimes daddy He comes sometimes, sometimes, and takes me back home	Last year he landed in New Zealand
9. Time get up: Thirty-eight	Tuesday
10. Take your nap: Don't tell me	On Tuesdays, Thurs- days and Saturdays
11. Have breakfast: Have dinner:	Nine o'clock
12. Daddy come home: Daddy stay home:	Mummy
17. Do on Sunday: Don't tell me	Oh a little after eleven
22. Do at Christmas: I have a Christmas tree and I put nice sings on it. I hope we'll have another one pret- ty soon	Oh seven-thirty
23. Soldiers do: Sailors do:	Seven-thirty. But eight o'clock is better
24. Time is it:	Oh one o'clock
	Oh eight o'clock
	Oh let's see
	About six. Yeah
	Monday
	Sunday, Monday, Tues- day, Friday, Saturday, Sunday
	Oh let's see. I have a manger at my home. You'll have to come and see me some day. (Ex. says she will.) Oh good

TABLE 13 (*continued*)

16.	Do yesterday:	Played
17.	Do on Sunday:	Read funny papers
18.	Do in winter:	Make snowballs and snowman and shovel snow. One day when I was a little baby it snowed in Philadel- phia
	Do in summer:	I like to play pool and ping-pong
	Do in spring:	I do the same thing
19.	AM or PM:	It's morning now
	PM begin:	It begins after nap
20.	Long nap last:	Oh it lasts till three o'clock
21.	Stay in school:	Till eleven o'clock
22.	Do at Christmas:	Oh Santa Claus comes and puts more presents on my Christmas tree
	Do at Easter:	Oh I get Easter eggs
	Do at Hallowe'en:	Oh see funny children
	Do at Thanks- giving:	Oh eat turkey
23.	Soldiers do:	March and drill too
	Sailors do:	Oh they teach the WAACS to be coastguards
24.	Time is it:	I can't think

the following cases considered, every one falls within the "superior" category, as rated on the developmental examination.

To illustrate the marked differences in understanding of time concepts, we present contrasting cases at each of three age levels: 30 months, 36 months, and 42 months (Table 13). At each age the responses of two children to our questionnaire are reproduced, one child being typical of the worst and one of the best responses given at each age. Questions which were not answered by the child are omitted here.

#### D. AGE SUMMARY

Marked individual differences appear (within any one level of age and intelligence) in different children's orientation in time. Some children have an excellent temporal orientation and express free and elaborate use of time words from a very early age. Others may never attain a really good temporal orientation. In spite of such individual variation, it appears that time concepts come into use in a relatively uniform sequence from child to child, and at about the same relative time in the life of every child. This suggests that readiness to acquire and exercise these concepts depends chiefly upon maturational factors and that there exists an underlying ground plan of growth, and a patterning process. In brief recapitulation, this patterning is as follows:

Words indicating the present come in first, then words indicating the future, and finally those indicating the past. Thus "today" (24 months) precedes "tomorrow" (30 months), which in turn precedes "yesterday" (36 months). This trend is evident both in spontaneous verbalization, in answers to questions, and in sheer volume of verbalization. There is a suggestion that time in relation to ends of things is understood before time in relation to beginnings.

Complete mastery of any one time concept does not appear all at once. Rather, there are several different levels of attainment. First the child can respond suitably to a time word as by waiting. Then he can use the word spontaneously; and finally can answer correctly questions dealing with the concept.

Children can tell at what time a thing happens in terms of some activity before they can give an actual clock time. Similarly, individual time words are used spontaneously in terms of specific contexts before they can be generalized. A rather elaborate expression of temporal order occurs as early as 30 months of age, but words which imply duration do not as a rule appear till 36 months.

As to general divisions of time, the child first knows whether it is morning or afternoon (4 years), then what day it is (5 years), then what time it is (7 years). Somewhat later comes knowledge of what month it is (7 years), what season (7 years), what year (8 years), and what day of the month (8 years). Days of the week are named correctly by 5 years; months of the year not until 8 years.

As to parts of the day, questioning indicates that children can first tell correctly when they go to bed (5 years), and then (with decreasing percentages) when they have supper, when they get up, when they go to school, and when afternoon begins (all at 6 years).

Most children can tell their age by 3 years; when their next birthday occurs by 4; how old they will next be by 5.

Developmental age gradations (for "superior" children) may be characterized for 11 age levels as given in Table 14.

TABLE 14

*18 months*

The 18-months-old child lives in the immediate present and has little if any sense of the past and future. He cannot wait. No time words are used by him, but he responds to the word "Now" and in his time psychology is interested in the "now."

There is some slight sense of timing: he may roll a ball and wait for it to stop before he pursues it. The sight of juice and crackers may bring him to the table.

*21 months*

The child still lives chiefly in the present. His chief time word is "Now." Projection into the future begins to come in. He will wait in response to "In a minute." There is an improving sense of timing: two children may rock in rhythm; or the child may sit at the table and wait for juice.

*24 months*

An important advance takes place at this age. Though the child still lives very much in the present, several words which denote *future* time (especially "gonna" and "in a minute") become part of his own spoken vocabulary. He will wait in response to such words as "wait," "soon," and "pretty soon."

He now has several different words to indicate present time: "now," "today," "aw day," "dis day." He uses no specific words implying past time, but is beginning to use the past tense of the verb, often inaccurately. The 2-year-old cannot answer questions involving time concepts, but he comprehends simple sequences as in the adult's promise, "Have clay after juice."

*30 months*

Though the child's vocabulary of time words may still be very limited (comprising probably not more than twenty or so different words), a definite advance takes place at this age in that he now uses freely words implying past, present and future time, having numerous different words for each. Thus the finer divisions of time—"morning" and "afternoon"—have been added to "day" to indicate present time. The future may be indicated by "some day," "one day," "tomorrow," and several others.

There are fewer different words for the past than for the future. Past time is usually designated as "last night." Though "tomorrow" is used, the word "yesterday" has not yet appeared.

Altogether, his time expressions sound quite versatile at this age, in spite of the smallness of his time vocabulary. He uses freely names of the days of the week.

#### *36 months*

More different new time words come in between 30 and 36 months than in any similar interval. Most of the more common basic time words are now in the child's vocabulary. Past, present and future are all referred to though there are still more different words for expressing the future than the past. There is now nearly as much spontaneous verbalization about the past and future as about the present.

Expressions of duration—such as "all the time," "all day," "for two weeks" come in at this age.

There is a pretense of telling time, and spontaneous use of clock time phrases usually inaccurate. There is much use of the word "time" alone or in combinations. Thus, "What time?", or "It's time," as well as "lunchtime," "puzzletime" etc. Phrases beginning with "when" are very common.

The child of three can answer a few questions involving time concepts. He can tell how old he is, when he goes to bed (in terms of some other activity) and what he will do tomorrow, at Christmas, in the winter.

At 3 years, and at no other age conspicuously, the child may perseveratively answer all questions about time with some one inappropriate clock time or some one number (as "fifty-nine").

#### *42 months*

Expressions indicating past, present and future time are now used in spontaneous conversation to an equal extent. Past and future tenses are used accurately.

There are many rather complicated expressions of duration, such as: "for a long time," "for years," "a whole week," "in the meantime." Or such phrases as "Two things at once." Also there come in at this age many different new ways of expressing sequence.

There is not so much an increase in number of time words used at this age, as in the refinements of use. The child says, "It's almost time," "a nice long time." He expresses habitual action, as "On Fridays."

With increasing complexity of time expressions comes a confusion characteristic of 42 months. The child frequently refers to future happenings as in the past. Thus: "I'm not going to take a nap yesterday."

Ability to answer questions about time is not much greater than at 3 years.

#### *48 months*

Past, present and future all continue to be used freely and about equally. Many new time words or expressions are added at this age. Particularly is the word "month" used in different contexts. Also such broad time concepts as "next summer," and "last summer," are used accurately.

By this age the child seems to have a reasonably clear understanding of when events of the day take place in relation to each other.

#### *5 years*

Data are limited from this age on. Present data indicate that in addition to the preceding concepts, which constitute a free verbal handling of the more common aspects of time, the child can tell what day it is, can name the days of the week in correct order, and can tell what day follows Sunday. He can also project forward to tell how old he will be at his next birthday.

#### *6 years*

At this age comes an understanding of the four seasons, and an increasing knowledge of duration.

#### *7 years*

Now the child can tell the season, the month and the specific clock hours (including how many minutes of or past the hour). The larger concept of what year it is, is still beyond him.

## 8 years

At this age the child can handle well extremes of time. He can not only tell the clock time but can also tell what year it is and what day of the month. He also indicates an understanding of the more generalized concept in his ability to answer the question: "What does *Time* mean?"

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# SHORT ARTICLES AND NOTES

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*The Journal of Genetic Psychology*, 1946, **68**, 127-130.

## MEASUREMENT OF THE MINIMUM EFFECT OF ENVIRONMENT, USING TWO-EGG TWINS\*

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MICHAEL NEWMAN

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### A. INTRODUCTION

A decade or more ago attempts to measure the relative influences of heredity and environment included two-egg (fraternal) twins with one-egg (identical) twins. The greater resemblance of two-egg twins compared with non-twin siblings was interpreted as further evidence on the weight of hereditary factors.

Subsequent criticism caught the fallacy, pointing out that two-egg twins were genically no more alike than non-twin siblings. Following this two-egg twins have been largely excluded from further study and from the interpretation of earlier studies of twins. Penrose (3) dismisses fraternal twins with the usual criticism and a remark that the correlation between traits should be one half.

Murphy, Murphy, and Newcomb (1) seem to have understood in a general way the correct evaluation of data on two-egg twins. They indicated (p. 36) that the greater similarity of fraternal twins as compared with non-twin siblings raised the question of how much effect environmental differences could have. There was, however, no attempt to answer the question and no further suggestions for using two-egg twins.

Woodworth (6) correctly evaluated one of the fundamental scientific uses of two-egg twins in the following sentence (p. 21): "There is really little point in comparing fraternal and identicals, there is more point in comparing fraternal with ordinary siblings, since the hereditary difference should average the same while the environment would on the whole be more alike for twins than for other siblings." Again the thought is not followed up. The idea does not reappear in further discussion or in the lists of suggestions for further study.

Rosanoff, Handy, and Plesset (4, 5) made various comparisons with two-

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egg twins. All but one of these comparisons were quite inconclusive because the genic and environmental differences were both present in large measure and inextricable from each other. One comparison was useful. Like-sex two-egg twins were compared with one-egg twins. Since the environments of many two-egg like-sex twins are very nearly as similar as those of one-egg twins the differences were attributable principally to differences in heredity.

#### B. THE LOGIC IN COMPARING NON-TWIN VS. TWO-EGG TWIN SIBLINGS

The foregoing survey indicates a passing recognition of the possible value of comparing two-egg twins with non-twin siblings, and the need to follow up an opportunity to throw further light on the ever important and baffling nature-nurture problem. The purpose of this paper is to develop this possibility.

The most important fact that springs from the etiology of two-egg twins is that, by and large, their hereditary resemblance is the same as that of non-twin siblings. In a large number of cases it is safe to assume the equality of genic relationship of two-egg twins and non-twin siblings.

Let it be understood in the ensuing discussion that a large number of cases is always assumed. What constitutes a satisfactory "large number" of cases may be a question for statisticians to decide. With proper random sampling technique actual experimentation may not have to be performed with an impracticably large number of cases.

It follows from the genic equality of two-egg twins and ordinary siblings that any differences in correlations of traits or syndromes must be due to differences in effective environments. Before the meaning of these differences is more exactly assayed certain precautions in choosing subjects must be noted.

Like-sexed twins should not be compared with unlike-sexed non-twin siblings or vice versa. This would introduce differences in genic resemblance in the form of sex-linked characteristics.

Great care must be exercised to not inadvertently exclude two-egg twins who resemble each other as much or almost as much as one-egg twins. In the past such pairs have frequently been included in the one-egg twin groups. This error can be avoided by applying the tests described by H. H. Newman (2). This precaution is very important because these are the pairs who will have the greatest environmental equality in all the population of different heredity.

We can now proceed further with the interpretation of the differences that have been found or may be found in future comparisons of two-egg

twins and non-twin siblings. Since non-twin siblings will have more similar environments than unrelated groups, differences due to environment between such siblings will be smaller than in the unrelated population. Therefore, a comparison of non-twin siblings with two-egg twins will show a difference due to environment which minimizes the environmental effects. In other words, whatever differences in resemblance are found between two-egg twins and non-twin siblings will be less than the true influence of the environment on whatever trait or syndrome we may be judging. In simple symbolic form it may be expressed thus:

$$D_s - D_t < E$$

where,  $D_s$  = difference between non-twin siblings

$D_t$  = difference between two-egg twins

$E$  = effect of environment

If a goodly number of non-twin siblings separated early into different environments is available for comparison with two-egg twins brought up together, a closer approximation of the full influence of environment may be obtained. The same crude formula would still be correct, however, because the usual separation, even in a broad cultural milieu like the United States, does not bring about a really radical change in environment, such as might be accomplished by having one of each pair of siblings placed in a primitive culture.

### C. CONCLUSION

A means of assessing the minimum susceptibility of any characteristic to environmental influence has been presented.

Detailed suggestions for application would go beyond the space limits here. In general, however, judgments of educability, of human plasticity and all its implications may be furthered by this technique.

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## AGE AND VOCATIONAL CHOICE\*

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This paper is concerned with the problem of the genesis of vocational choice, and, specifically, with the ages at which certain enduring vocational interests first appear.

Vocational interests, the harbingers of vocational choice, are of multiple determination, being the products of such factors as social approval, financial remuneration, and aptitude. Each individual, no matter what his native endowment, is capable of developing many vocational interests, and in many persons the age at which a vocational choice was made simply represents the time at which resolution of conflicting interests occurred. The age at which a final decision is reached in the matter of occupation varies from individual to individual, and is influenced by such variables as the person's intelligence, the socio-economic status of parents, sex, the presence or absence of adult guidance, prevailing economic conditions, and the availability of vocational information. It may be noted that most of the aforementioned factors are environmental in character.

It may be mentioned that the appearance of interest in a line of work carries no guarantee that the interest will endure. As a matter of fact, many early vocational interests perish as the individual's field of choice expands and his knowledge increases. The survival value of some vocational interests is, perhaps, higher than for others.

Since entrance into many occupations is based upon competition, those who are least capable may be forced into occupations for which they have no preference. The correlation between vocational choice and vocational preference is far from perfect.

In 1941 the Bureau of Vocational Guidance at the Southern Branch of the University of Idaho sent questionnaires to a large number of former students who had attended the institution between 1936 and 1940.<sup>1</sup> Each former student was asked to state the occupation in which he was engaged or for which he was preparing, and to name the age at which his interest in

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<sup>1</sup>The writer wishes to acknowledge the assistance of W.P.A. Project Number 165-1-92-71 for its help in sending out and tabulating the questionnaires referred to in this paper.

the occupation first became manifest. The results of this survey are summarized in Table 1.

TABLE 1  
AGES AT WHICH FORMER U.I.S.B. STUDENTS FIRST BECAME INTERESTED IN THEIR  
PRESENT OCCUPATIONS

Age	No. of students	Age	No. of students
Under 10	11	20	38
10	1	21	9
11	2	22	7
12	8	23	1
13	5	24	2
14	12	25	1
15	19	26	1
16	32	27	1
17	35		
18	55		
19	42		
		<i>N</i> =	282

It is interesting to note that there was a steady increase in the number of cases at each age beyond the age of 9, reaching a peak at age 18, after which there was a gradual decline. It is the opinion of the writer that the peak reached at age 18 is to be attributed to certain environmental forces which compel vocational thinking at this point. This is the age at which most students complete their high school work and either enter college or go into employment.

Deserving of emphasis is the fact that a high percentage of the students covered by this survey grew up on farms, and hence their development of vocational interests may have been delayed in comparison with urban youth.

Those who participated in the investigation were asked to describe the circumstances whereby they first became interested in the occupation of their choice. The most frequently cited answers were as follows: by studying various school subjects, 45; through the influence of parents, relatives and friends, 43; by talking to and observing people in the same occupation, 36; was given an opportunity to do a little work in the occupation, liked it, and decided to make it my life work, 29; as a result of the influence of school teachers or professors, 27.

It is significant that the vocational interests which developed through school influences showed the highest survival values. Apparently, our schools play a larger rôle in the determination of vocational interests than any other agency in our society. They enable students to appraise more accurately their own capabilities, and they frequently stimulate the development of interests which culminate in vocational choice.

Implied in the writings of Strong (1) and others is the assumption that the development of vocational interests is maturational in character. It is the opinion of the writer that the development of vocational interests is due to the interaction of cultural and biological factors, rather than to either alone. Although it cannot be denied that certain vocational interests may be determined partially by inherent propensities, it does not follow that these tendencies must wait upon adolescence for their appearance. On the contrary, there is a large and growing body of psychological data which indicates that occupational interests are demonstrable and measurable at much earlier ages. Many vocational aptitudes are evident before the age of 10.

Often a number of years intervene between the appearance of a vocational interest and its final acceptance as the individual's life work. Such delay is due, in many cases, to the absence of adequate guidance facilities and to lack of social pressure.

Most authorities agree that women mature psychologically at an earlier age than do men. If biological factors were the principal determinants of vocational interest and choice, one would expect females to reach vocational decisions at earlier ages than males. However, it is well known that females, on the average, settle upon occupations at later ages than do males. This is easily understandable on an environmental basis. Girls have fewer choices and are under less pressure to elect occupations; hence their vocational thinking often is delayed in comparison with that of boys.

Stability of vocational interest and choice beyond the age of 25, for which there is some corroborative evidence in this paper, may be attributed to such factors as psychological inertia, to social obligations which make it difficult, if not impossible, for a person to change his work, and to limitations imposed by background. Vocational possibilities tend to diminish as persons grow older; a man who first decides to become a physician at age 30 or 35 will find great difficulty in realizing his ambition, unless he has been very fortunate in terms of previous education. There is no lack of data to show that a large percentage of people beyond the age of 25 are unhappy in their occupations, and wish they were engaged otherwise. Sometimes stability of vocational interest is due to lack of information regarding opportunities.

It is the belief of the writer that the psychological factors involved in vocational choice can be isolated, measured, and acted upon long before age 18, provided that there is more school and home emphasis on the problem of selecting an occupation. Our youngsters usually delay their vocational decisions because they are not forced to do vocational thinking until late in their school careers.

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## BOOKS

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The *Journal of Genetic Psychology*, the *Journal of General Psychology*, and the *Journal of Social Psychology*, will buy competent reviews at not less than \$2 per printed page and not more than \$3 per printed page, but not more than \$15.00 for a single review.

*Conditions.* Only those books that are listed below in this section are eligible for such reviews. In general, any book so listed contains one or more of the following traits: (a) Makes an important theoretical contribution; (b) consists largely of original experimental research; (c) has a creative or revolutionary influence in some special field or the entire field of psychology; (d) presents important techniques.

The books are listed approximately in order of receipt, and cover a period of not more than three years. A reviewer must possess the Ph.D. degree or its equal in training and experience.

*Procedure.* If among the books listed below there is one that seems important to you, you are invited to write a review of that book. It is not necessary to make arrangements with the Editor. Just send in your review. It does not matter if the book in question has been reviewed before.

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## CRITICAL REVIEWS OF RECENT BOOKS

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*The Journal of Genetic Psychology*, 1946, **68**, 137-143.

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REVIEWED BY GEORGE G. THOMPSON

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In this report Dr. McGraw summarizes a series of research studies on the behavior development of the growing infant which were begun more than 10 years ago. These studies were stimulated by the author's association with Dr. Frederick Tilney, who had been investigating structural changes in the brains of human infants by means of histological analysis. Because of her close contact with these structural studies, the author was able to conduct appropriately related research on the behavior development of infants and young children.

An attempt is made throughout this book to demonstrate a general correlation between changes in brain structure, as revealed by histological analyses of the brains of human infants, and changes in infant behavior, as revealed by controlled observations. The author admits that data on the morphological growth of the human nervous system are meager and that evidence based on neurophysiological and neurochemical investigations is needed before a very comprehensive understanding of neural functioning will be possible. However, on the basis of available knowledge of the structural development of the brain, McGraw believes that several tentative assumptions about the morphological growth of the human nervous system can profitably be made. These assumptions about neuromuscular development are then used as a theoretical framework within which to interpret changes in overt behavior during infancy and early childhood.

The present theory is not regarded by McGraw as a final, irrevocable construction, but is merely considered a useful and workable concept until greater definition becomes possible. The author very succinctly states the major psychological contribution of her work in the following statement:

Even if the interpretations which have been presented should prove to be false, the detailed documentary descriptions of developmental change in overt behavior should provide material for more specific determinations of the relationship between behavior development and maturation of neural structures (p. viii).

Since the assumptions about structural development presented in Chapter I

provide the framework for the remainder of the report, a summarized version of these assumptions follows: (a) the two major divisions of the central nervous system controlling neuromuscular functions are the cerebral cortex and the subcortical nuclei; the cells of the subcortical nuclei which constitute a more primitive part of the brain begin to mature and are ready for action much earlier than are the cells of the cortex; (b) since the cerebral cortex at birth is not functioning appreciably to control behavior, the behavior of the newborn human infant is mediated by the subcortical nuclei; (c) some behavior patterns are essentially dominated throughout life by the subcortical centers; (d) some behavior patterns of the newborn appear to be residuals of phylogenetic functions no longer useful to the human species; (e) as the cerebral cortex develops it begins to facilitate neuromuscular functions and to inhibit the activities mediated by the subcortical nuclei; (f) developmental changes in overt behavior are correlated with cortical maturation; with cortical maturation some behavior patterns are diminished or suppressed and other neuromuscular performances emerge and become integrated; (g) there is a cephalocaudal trend in development; (h) morphologically, the cerebral cortex does not grow uniformly; the motor area is the most highly developed at birth and is the first to develop in postnatal life.

These propositions are based on or inferred from research evidence on the structural development of the human brain during the prenatal period, the neonatal period, and early infancy. The data on brain morphology at various developmental periods are drawn largely from the research studies of Tilney, Conel, and De Crinis.

In Chapter II entitled "Neonatal Behavior," the author reviews some of the sensory, reflex, and motor activities of the neonate, and states that these behavior patterns of the newborn can be explained on the basis of the subcortical sections of the infant's nervous system. McGraw states that practically all of the behavior patterns characteristic of the normal newborn can also be elicited from decerebrate infants. "Such observations lend additional evidence to the general thesis that the cerebral cortex is not functioning at the time of birth."

According to the author's theoretical framework the behavior patterns of the human infant are controlled by the following developmental levels in neuromuscular maturation: (a) behavior mediated by subcortical or nuclear mechanisms; (b) diminution of overt behavior as a result of cortical inhibition; (c) voluntary behavior as cortical control becomes more complete; and (d) smooth performance as the various neural centers are integrated.

In Chapter III data are presented on the development of reflex and

motor activities during infancy and early childhood. These research findings constitute the heart of this report, and as interpreted by the author fit very satisfactorily into her theoretical framework of sequential, neurological development: subcortical or nuclear control, cortical inhibition, cortical control, and integration of neural centers.

The author's study on the development of suspension grasp behavior demonstrates how the duration of the grasp behavior increases during the first 20 to 30 days of life (interpreted as expansion in the development of nuclear centers), how the duration of this behavior decreases between 30 and 100 days of age (interpreted as cortical inhibition), and how the duration of this behavior steadily increases between 400 and 2,500 days of age (interpreted as the development of cortical control and integration of neural centers).

Results of McGraw's research on the duration of the Moro reflex with increasing age also support her proposed theory of neuromuscular maturation. Graphically presented data demonstrate how the duration of the Moro reflex increases during the first 25 days of life (expansion of the development of nuclear centers) and then steadily decreases, with the exception of a minor increment between 60 and 100 days. This decline in the duration of the Moro reflex is interpreted by the author as the development of cortical inhibition.

By both direct observation and analyses of motion pictures the author has obtained data less easy to quantify on the development of the following types of motor activities during infancy and early childhood: swimming, postural adjustment to a position of suspended inversion, rolling from supine to a prone position, crawling and creeping, development of a sitting posture, assumption of an erect posture, and the achievement of erect locomotion. These data, which have been reported previously by the author in various scientific journals, are lucidly summarized in this report by means of graphs and line drawings. As interpreted by the author, all of these data support the proposed hypothesis of neural maturation and correlated behavior development.

Chapter IV deals with the development of two types of sensori-motor function: reaching-prehensile behavior and response to pin prick. McGraw concludes on the basis of Conel's research that the motor cortex matures earlier morphologically than the special sensory areas. It is, of course, impossible to demonstrate that this state of affairs is mirrored in behavior development, since the infant cannot verbally report his sensations and overt motor behavior must be used as evidence of sensory experience. However,

as McGraw points out, overt behavior can be used to study progressive changes in sensory development.

The following progressive changes in reaching-prehensile behavior are recognized by McGraw: (a) *the newborn or passive* (no overt response); (b) *object-vision* (fixation, convergence and distance accommodation); (c) *visual-motor* (when object is fixated, child reaches for it in an automatic fashion—sometimes with closed fists); (d) *manipulative and deliberate* (when object is seen, child may reach for it or put finger on it—reaching has lost its automatic character, but child must still attend closely to object while reaching); (e) *visual release* (after one brief look, child may reach for object without sustained attention); (f) *mature* (minimum effort expended in this type of behavior). The progressive changes in reaching-prehensile behavior and response to pin prick are interpreted as indications of development or maturation of the structural mechanisms for cutaneous sensibilities and for neuromotor functions.

Some of the more strict behaviorists may be somewhat disturbed by McGraw's statements in this chapter that certain patterns of behavior show cognizance or awareness in the infant. The following suggestion of a correlation of psychological function with a restricted brain area would probably also be questioned by many psychologists. "Since these critical phases in each function usually occur sometime during the last quarter of the first year, it may be that the quality of 'deliberateness' refers to some specific or local area of the cerebral cortex."

In the eight pages of Chapter V McGraw summarizes a previously reported research analysis by Campbell and Weech of the interrelations in the behavior development of sitting, creeping, walking, reaching for a lure, and reacting to the prick of a pin during the first six or seven months of life. The data of this study consisted of observations on 40 children, including five sets of unisexual twins. This research analysis was made to determine the correlation between these various types of motor development; i.e., is a child who is developing at a certain rate with respect to the group in one motor function also developing at the same rate in other motor functions; also is an infant's rate of motor development with respect to the group constant or variable. The conclusion drawn from this analysis is that up to 150 days there is "... the emergence of an increasingly accurate characterization of the individual." McGraw concludes, "The centers which relate to the reflexes involved in early sitting, creeping, and walking behavior are different and relatively independent." This conclusion about the relatively low correlation between different motor functions is supported by

research with older children. From this analysis the author also concludes, "... as the infant grows older and as maturation in his cortex progresses the influence which coördinates behavior becomes stronger. The circumstances allow one to think that the cortical centers themselves influence this change."

In the final chapter entitled "Maturation and Learning," McGraw discusses the evolving concept of maturation and states some pedagogical principles which she believes can be derived from the studies reported in this volume. The author traces the development of some of the older learning theories and gives a brief history of the development of the concept of maturation.

It was the students of infant behavior who first applied the term "maturation" to behavioral growth. They adopted the term because changes were observed in the behavior of the growing infant which could not be adequately explained in terms of either trial and error or conditioning theories of learning (p. 120).

McGraw states a definition of maturation that has in her opinion become generally accepted: "... in recent psychological literature 'maturation' has been used more and more to refer to changes in behavior which result from anatomical or physiological development in the nervous system, the emergence of which is not associated with known external stimuli." The weakness of the concept is demonstrated in the latter part of this definition. It is tantamount to saying that all emerging patterns of behavior which are correlated with external stimuli are learned and the remainder are due to maturation—a tenuous grab-bag type of scientific construct.

Dr. McGraw is not unaware of the almost inextricable mingling of maturation and learning. She states:

Most of the neuromuscular functions discussed in the preceding pages are considered to be the result of a maturational process, yet it is obvious that many of them assume at a certain period the fundamental qualities of learning. The developmental course of these early organic behavior activities offers helpful suggestions for the formulation of pedagogical theories (p. 122).

The educational principles which McGraw believes should flow from these studies on the maturing nervous system of the infant are presented below.

1. Training in any particular activity before the neural mechanisms have reached a certain state of readiness is futile.
2. Exercise of a newly developing function is inherent in the process of growth, and if ample opportunity is afforded at the proper time,

specific achievements can be advanced beyond the stage normally expected.

3. Periods of transition from one type of neuromuscular organization to another are an inherent part of development and are often characterized by disorganization and confusion.

4. Spurts, regressions, frustrations, and inhibitions are an integral part of organic growth, and there is reason to believe that they also function in the development of complex behavior activities.

5. Maturation and learning are not different processes, merely different facets of the fundamental process of growth.

6. Evidence that a child is ready for a particular educational subject is to be found in certain behavior "signals," or behavior "syndromes," [*sic*] which reflect the maturity of neural mechanisms.

Most of these educational principles are now recognized and accepted by modern educators and more enlightened parents. For example, much time and effort have been expended by educational research workers to develop tests of "reading readiness" which are based on the educational principle that there is a developmental period during which reading as now taught can be mastered to best advantage. Attempts have also been made by educational research workers to determine the most appropriate developmental periods for introducing children to the study of other school subjects. The results of this type of research have been far from clear-cut and have not been sufficiently impressive to revolutionize established school procedures.

It may be that further research will uncover these "small signs," "behavior criteria," or "signals" that bear evidence that a child is ready for a particular educational subject. However, it may also be that these higher mental processes—more complex than sitting, walking, bladder control, etc.—are not so inflexibly bound to the density of the neuropile, the amount of myelin, or other morphological characteristics of the cortex. It may be that McGraw has studied too brief a segment of human development to extrapolate her findings to complex behavior during the elementary school years and beyond. Much research needs to be conducted before a definitive answer can be obtained to these questions.

McGraw concludes her treatise with these words, "Neurologists tell us that man does not begin to use all the cells in the cerebral cortex. An optimum educational system may be able to tap some of these reserve neural potentials." With this hope psychologists and educators will heartily concur. Certainly a more thorough knowledge of experiential levels in the psychological development of the child—including information on past learning as well as maturation—should be helpful to educational philosophers and policy makers.

The contents of this report make a distinct contribution to our knowledge of child development. The educational implications presented by the author are intriguing and should give added impetus to educational research on curriculum construction. The proposed theory of neuromuscular maturation presents a challenge to future research workers and should stimulate further research of the type to which McGraw has devoted more than 10 years of serious thought and research endeavor. This book deserves a wide audience of critical readers in psychology and education, for it presents a valuable summation of histological and psychological research. The present reviewer does not agree with several of the author's theoretical interpretations, and believes that other readers may also question some of them. However, such disagreements with a systematic theory are to be expected and should in themselves contribute to the field of child development by stimulating further research.

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## BOOKS RECENTLY RECEIVED

*(There will always be two pages of book titles, listed in the order of receipt, i.e., the most recently received books will be found at the end of the list.)*

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## AGE AND SEX DIFFERENCES IN THE PERCEPTION OF INCOMPLETE PICTURES BY ADULTS\*<sup>1</sup>

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ELINOR VERVILLE AND NORMAN CAMERON

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### A. INTRODUCTION

Many experimental studies of perception have neglected to investigate systematically those factors determining individual differences. This study is designed to determine the effect of age and of sex in the perception as whole pictures of incomplete silhouettes of common objects. Similar test material was used by Street (4) in an attempt to compare ability to recognize incomplete pictures with intelligence, and by Leeper (1), who studied the effect of coaching on ability to recognize incomplete pictures, and also determined retention of perceptions previously made.

Street's subjects were 210 pupils in the sixth grade of a Manhattan school, who were shown 13 incomplete pictures in ascending order of difficulty as previously determined by the responses of 754 grade and high school students. Each picture was held by the experimenter before the group and moved backward or forward at the subjects' request. Each child recorded the picture he saw, and if he wrote the name of the object from which the incomplete picture was derived, he was credited with one point. The picture was presented for two or three minutes, and there was no precise indication of the time necessary for perception. Both the Kuhlman-Anderson and a sentence completion test were given to all subjects, and the Healy Picture Completion Test II to a sample of 90 subjects. Street found no correlation between these tests of intelligence and scores obtained on the incomplete pictures, and no consistent differences in score between the sexes or the age groups. However, in selecting his test series of pictures he had eliminated those which showed sex and age differences in the pre-test group of subjects.

Leeper used eight of Street's figures, one adaptation of a figure of Street's, and 10 new figures. These incomplete pictures were projected on a screen before groups of 9 to 24 subjects, students in a college summer session. Each subject recorded what he saw, whether it was clear, and

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the approximate time necessary to respond, time being called by the experimenter every second during the first five seconds, and then in five-second intervals. The experimenter aided perception by showing subjects the original drawing from which the incomplete figure was derived, naming the class of objects to which the figure belonged, or naming the object itself. The pictures were exposed from 20 to 180 seconds, depending on their difficulty. A final presentation, 22 to 25 days after the previous one, was an exposure of .01 second, followed by an exposure of one second. Thirteen new drawings were interspersed with the original figures, and a control group of 20 subjects saw the pictures for the first time. Leeper found that verbal and visual assistance helped subjects to see the pictures correctly, and that there was retention of the perception over the three weeks' interval, even for the very short exposure time. He reported no data for sex or age differences.

#### B. MATERIALS AND METHOD

Because some of the figures used by Street and Leeper have been reproduced and discussed in current text books (3, pp. 257-260; 5, p 75), a new set of 10 pictures was prepared which represented objects familiar in everyday life. Parts of each figure were deleted in such a way as to present the subject with a design that was novel to him. In order of presentation, the figures were of a frog, a child on a sled, a steamship, a piano, a horse drawing a sleigh, a steamshovel, a car, two boxers, an airplane, and a cowboy on horseback (Figure 1).

Projected on to a translucent glass screen, each picture measured 7" x 4 $\frac{3}{4}$ ". A single switch flashed the picture on and off the screen and started and stopped a noiseless electric stop clock which measured in fifths of a second, so that exact timing of the exposure was possible. A ceiling light and a small light behind the screen reduced after-images. Each subject, sitting four feet from the screen, was tested individually, and the experimenter and all apparatus were concealed from his view.

Subjects were 100 University of Wisconsin students and 30 older adults, equally divided as to sex. Range in age of the student group was 16 to 23 years, with a mean age of 20, and scholastic classification ranged from freshman to graduate. The older group ranged in age from 35 to 56 years, with a mean age of 45. University professors and their wives, and women engaged in university teaching, editorial work, or business were the subjects in the older group. Their minimal educational background was comparable to the educational status of the younger adults.

After the subject had seated himself and his name, age, sex, and college

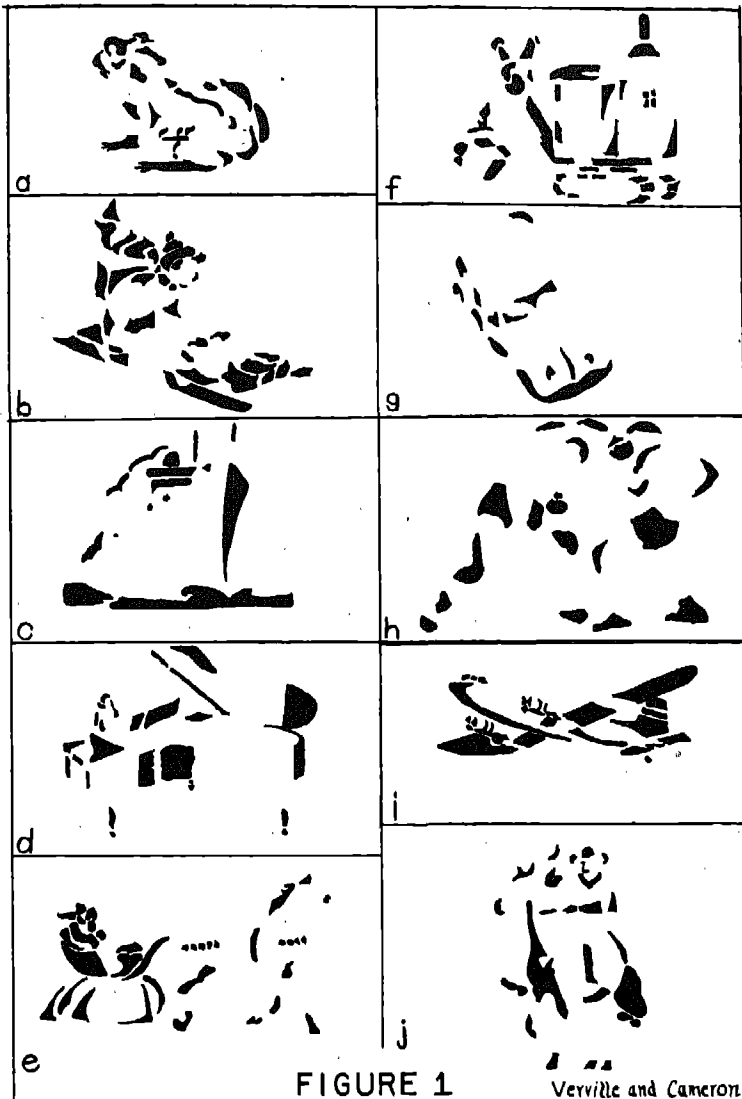


FIGURE 1

Verville and Cameron

year, if a student, had been recorded, these instructions were read to him: "I am going to show you a number of incomplete pictures. As soon as you recognize the picture, name it immediately. Do you understand? I will give you a 'Ready' signal before showing each picture."

A record of all responses of the subject was taken, and the approximate time at which they were made was noted. If a subject expressed satisfaction with an incorrect answer, or did not wish to keep looking at the picture any longer, he was encouraged by being told, "*Look for a little while longer, and see if you can see anything else,*" or "*Keep on looking.*" Questions of the subject such as, "*Is it an animal?*", "*Is that right?*", and "*Am I warm?*" were not answered.

As soon as the subject named the picture correctly, the projector light was turned off, the subject's response time thereby being clocked. If the picture had not been seen correctly at the end of five minutes, the projector light was turned off, a verbal prompting was given the subject, and the picture shown again immediately. Promptings were: frog, "*This is an animal*"; child and sled, "*This is a plaything used in winter*"; steamship, "*This has something to do with the ocean*"; piano, "*This has something to do with music*"; sleigh, "*This is an old-fashioned means of winter transportation*"; steamshovel, "*This has something to do with digging*"; car or airplane, "*This is a means of transportation*"; boxers, "*This represents a sport*"; cowboy, "*This has something to do with the West.*"

If the subject failed to identify the picture within two minutes after the prompting was given, the next picture was shown.

### C. RESULTS

Since most subjects responded quickly, use of the reaction times as data from which to compute the significance of differences would have been an inaccurate statistical procedure, since they formed a curve skewed markedly to the right. In order to minimize the skewness, the reaction times in seconds were converted into point scores, according to the frequency of their occurrence. The lowest possible reaction time score for a picture was one, which was given if the picture had been identified correctly in 1.5 seconds or less, and the highest possible reaction time score was 9, which was assigned if the subject had failed to identify the picture in seven minutes. Critical ratios were computed between the mean scores for younger men and younger women for each picture and for the mean score for the set of 10 pictures. The significance of differences between scores of older men and older women, younger men and older men, younger men and older women, younger women and older women, and younger women and older men was computed by obtaining  $t$  for each picture and for the mean score for the set.

The significant differences between the groups are given in Table 1, with the subjects reacting more quickly listed at the top of the table. Nineteen

of the 26 differences are significant at the 1 per cent level of confidence, three at the 2 per cent level, and four at the 5 per cent level.

TABLE 1  
CRITICAL RATIOS AND *t* VALUES BETWEEN THE GROUP REACTION TIME SCORES

	Younger men	Younger women	Older men
Younger men		2.64—sled	
Younger women	5.39—shovel		
Older men	11.68—shovel 2.66—ship * 2.17—piano 4.31—car 3.12—set mean	2.98—ship 2.99—car	
Older women	8.49—shovel 3.10—ship ** 2.33—piano 6.42—car 3.98—boxers 5.26—airplane ** 2.66—cowboy 5.51—set mean	*2.24—shovel 3.46—ship 4.68—car 2.58—boxers 4.56—airplane 3.28—set mean	*2.10—shovel **2.51—boxers *1.98—set mean

\*Difference significant at the 5 per cent level of confidence.

\*\*Difference significant at the 2 per cent level of confidence.

There was no consistent sex difference in the younger adult group, since the women were quicker than the men in seeing correctly one picture, and the men quicker than the women in seeing correctly one picture. For eight of the 10 pictures there were no significant sex differences in the younger group.

In the older group, however, men were quicker than women in seeing correctly two of the pictures, and their mean score for the entire set was significantly lower than that of the women.

Age differences were marked. Younger women were quicker than older men in seeing two of the pictures, and they were quicker than older women in seeing five pictures, and on the average, the complete set. Younger men were quicker than older men in seeing four pictures and their average score for the set of 10 was lower. They were quicker than older women in seeing seven pictures, and on the average, the complete set.

In the younger group taken as a whole, promptings were necessary because of failure after five minutes of testing in 6.3 per cent of the total trials, but in the older group they were required in 13.3 per cent of the total trials. Correct perception within the additional two-minute limit fol-

lowed 66.7 per cent of the promptings in the younger group and 62.5 per cent of those in the older group.

Men as a group required promptings in 6.1 per cent of their total trials, and of these 60 per cent led to correct perception within the following two minutes; and women required promptings in 9.5 per cent of their total trials, 67.8 per cent of these being followed by correct perception.

The difficulty of a given incomplete picture varied with age and sex. In Table 2 the 10 pictures are ranked in increasing order of difficulty according to the reaction time score of each group.

TABLE 2  
DIFFICULTY OF PICTURES ACCORDING TO REACTION TIME SCORE

Younger men		Younger women		Older men		Older women	
Airplane	1.16	Airplane	1.24	Airplane	1.60	Airplane	2.07
Car	2.22	Frog	2.30	Frog	2.60	Sleigh	2.93
Frog	2.30	Car	2.64	Sleigh	2.73	Frog	3.07
Shovel	2.36	Piano	2.78	Piano	3.20	Piano	3.27
Piano	2.38	Sleigh	3.30	Boxers	3.40	Cowboy	4.20
Cowboy	2.84	Cowboy	3.44	Cowboy	3.67	Sled	4.27
Boxers	2.90	Ship	3.50	Shovel	3.80	Car	4.93
Sleigh	3.04	Boxers	3.54	Sled	4.07	Shovel	5.13
Ship	3.60	Sled	3.68	Car	4.20	Boxers	5.27
Sled	4.54	Shovel	3.94	Ship	5.73	Ship	6.07

#### D. DISCUSSION

Although sex differences exist in the younger adult group, they do not show that one sex is consistently quicker in perception of incomplete pictures than the other. However, a tendency for the men to react more quickly than the women is observable in the comparisons made of the reaction time scores of the younger subjects with those of the older men and women, since a greater number of significant differences was found between the older subjects and the younger men than between older subjects and younger women.

Quicker reaction of men is clear in the older age group, in which men were not only quicker than women in identifying the picture of the steam-shovel and of the boxers, but had a quicker mean score for the entire set of 10 pictures than did the women.

These results, along with the consistent finding of quicker reaction of the younger adults regardless of sex, suggest that a cursory analysis of the testing situation might be helpful in discovering qualitative differences among the groups, which may involve factors associated or interrelated with age and sex.

Some subjects were apprehensive about their ability to perceive the pictures, and suspected the test to be one of intelligence or motivation. This attitude seemed to be more characteristic of the older group than of the younger. The college students, accustomed to testing situations, probably entered the experimental room with more curiosity than concern, and it is possible that this attitudinal difference may have influenced the results.

A second contributing factor may have been in the subjects' ability to avoid set in perceiving. The objects were pictured from a side view, a front view, or a top view, and inability to eliminate the set established by looking at the previous picture would hinder quick perception. A set for a class of objects was observed in some subjects, who, after correctly identifying the first picture as a frog, continued to name animals for one or more succeeding pictures.

A third factor may have been a reaction to success or failure with the first pictures which influenced the perception of succeeding ones. Failure to perceive a picture correctly was not infrequently followed by failure or a slow reaction to the following picture. The effect of emotional attitudes on ability to perceive the pictures has been investigated by one of the authors and is reported in another paper.

Notable age differences in the ranking of the pictures for difficulty are the quick responses of the older group to the horse and sleigh, and of the younger group to the car. However, a comparison of the percentage of subjects in each group who named the sleigh correctly without misnaming it first shows no great difference between the age groups: 90 per cent of the younger men, 86 per cent of the younger women, and 93 per cent of the older men and women did so. The car, however, drawn from a top view, was named correctly without first being misnamed by 98 per cent of the younger men and 92 per cent of the younger women, but by only 66 per cent of the older men and 60 per cent of the older women. They called it a baby's shoe or a toboggan.

The picture of the steamshovel was perceived readily by the younger men, in contrast to the difficulty which the other subjects had with it. There is some indication that this picture showed a sex difference, with 98 per cent of the younger men and 86 per cent of the older men calling it correctly without first misnaming it, and only 72 per cent of the younger women and 40 per cent of the older women being able to do so. The picture was misnamed a castle, windmill, or houses.

Most difficult pictures for the younger men were those of the ship and the sled; for younger women, the sled and steamshovel; for older men, the car

and the ship; and for older women, the boxers and the ship. Why the younger subjects had difficulty with the picture of the child and sled cannot be said. They often called it skiing, or identified the child and provided him with a dog or other animal. The picture of the steamship was difficult because it was drawn so that it might easily be seen as a group of small pictures: a sailboat, seagulls, and water. Once this sea-scape was seen, it was hard for a subject to shift his set and combine these small pictures into a single picture of a large ship. The picture of the boxers was well drawn, but there were many omitted parts, and the picture was most often misinterpreted as an animal. Four legs could be counted and the back of one of the boxers was taken for the lowered head of a cow or sheep. Older subjects, perceiving the figure in this way, persistently named animal after animal, instead of shifting to a different object when they found their guesses to be incorrect.

A comparison of the number of pictures which 80 per cent or more of the subjects in each of the four groups were able to name correctly without previous misnaming substantiates the general conclusions which can be made from the reaction time scores. On their first report, 80 per cent of the younger men identified correctly eight of the figures; younger women identified seven; older men, six; and older women, four.

#### E. SUMMARY

1. Ten incomplete pictures of common objects, none of which had ever appeared in print or been used experimentally before, were shown individually to 100 college students, between the ages of 16 and 23, and to 30 professional persons, aged 35 to 56, equally divided as to sex.

2. No consistent sex differences in reaction time scores were found in the younger adult group, since men were quicker than women in naming correctly one picture, women were quicker than men in naming another, and there were no significant differences on the other eight pictures.

3. A sex difference of quicker reactions by men was found in the older group in the naming of two of the pictures and in the average reaction time score for the set of 10 pictures.

4. The younger men and women reacted more quickly than did the older men and women. Young men obtained reaction time scores that were quicker than those of older men for four pictures, and on the average, for the entire set. Their reaction time scores were quicker than those of older women for seven pictures and for the average of the set. The reaction time scores of younger women were quicker than those of older men for two of the

pictures, and quicker than those of older women for five of the pictures and for the average score of the complete set.

5. Leeper's observation that verbal prompting aided perception was confirmed.

6. Age and sex differences were identifiable also in a comparison of the difficulty of individual pictures for each group of subjects.

7. Suggested factors operating in the production of individual differences along with those of age and sex are (*a*) the ability to eliminate set established by the preceding picture, and (*b*) the effects of success, failure, and apprehension on perceptual reaction time.

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BEHAVIOR NOTES ON *E. INSULARIS* HENTZ: DOMESTICATION, INVOLUTION\*<sup>1</sup>

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F. L. WELLS

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About the middle of a previous September, there was observed in the dining-room of the writer's house, on a door leading towards the cellar, a spider occupying perhaps a 6" orb of the usual *Epeira* type. The legs were light yellow with reddish bands; about the length associated with a small adult *E. insularis*. The abdomen was about the bulk of a fair-sized pea, presented a shrunken appearance, with an unusual salmon color predominating. The spider remained continuously at orb-centre. After a day or two there was placed in the web a freshly killed *T. tepidariorum*. This she attacked very actively, in a manner normal for a live capture, wrapping and biting, and fed on it. That evening she disappeared, but three or four days later turned up near a mantelpiece in the living-room, having passed two doors and across a hall to reach this spot. She was again fed but remained only two or three days, when she next turned up some seven feet away, near a coign formed by a beam running across the ceiling between two side walls. In this location she remained. During October she was abundantly fed with crickets and grasshoppers, causing the abdomen to become perhaps three times its former size, with some color-change; the distended abdomen now predominating in a deep orange color, with the usual darker trefoil markings on the dorsum. She established a retreat where the wall met the ceiling, but during October and early November divided her time irregularly between retreat and orb-centre, with much independence of time of day. Gradually she came to spend more and more time in the retreat, and after mid-November was scarcely seen at orb-centre at all. (It must be rarely if ever, that a living *E. insularis* is locally observed in the field, as late as November 1.)

When food was placed in the web, it was during the early days scarcely necessary to use any means to attract her to it. Gradually it became necessary to use more and more tuning-fork stimulation to attract her to the food, though once it was located, she would take it in a normal manner. At first

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<sup>1</sup>*E. gigas* Leach; *E. marmorea* C. Koch; *E. raji betulae* Sulz. Taxonomy by advice of Miss E. B. Bryant.

she fed mainly at orb-centre, later entirely in retreat. After insects could no longer be obtained in the field, she was fed one mealworm per week, which seemed to keep her in a good state of nutrition. On November 25 she for the first time could not be induced by repeated fork stimulation to approach a mealworm, but some time that night she must have taken it, as she was observed feeding on it in her retreat the next morning. At this time she had not spun a web for at least two weeks; the old web was quite dusty, and tattered from the capture of other mealworms placed in it. It continued in this dilapidated condition, with the spider so inert that on December 2 it was sought to ascertain if she were still alive. As there was no response to various proddings she was presumed to be dead and preparations were made to collect her, but on approach of forceps she stirred somewhat, and was let be. The web and retreat were not conveniently accessible, and in endeavors to reach her various strands had been broken, though the remnant of the orb itself seemed not to suffer. The breaking of these strands apparently offered a critical stimulus, for that night she constructed an entirely fresh and normal appearing web of good size. On the floor beneath were recovered six dusty masses of fluff, apparently rolled up discards of the former web (cf. 3, p. 158).

The spider's retreat was now marked by a heavy silk platform, beneath which she rested at practically all times of observation. This new web construction seemed to leave her in a more alert condition, for upon the touch of a tuning-fork to the web on December 4, she dropped at once to orb-centre, in the normal manner for making a capture. Here she remained for a minute or two, and was noted to appear sleek and well-nourished. Offered her regular mealworm the next evening she responded with special promptness to the tuning-fork, located the worm readily, wrapped it with special energy and thoroughness. But thereafter to December 25 she was practically inert, only once observed outside the retreat, while the web became ragged and dust-laden. On December 25 she was offered a well-grown mealworm, but could by no means be induced to pay any attention to it. It remained in the web overnight, and the next day was placed in the retreat itself. During this process the spider was disturbed and fled with normal agility, once dropping some 18 inches and climbing back, later moving laterally along the molding for some two feet, and resting there. Later in the day she returned to the retreat but paid no attention to the mealworm, neither accepting nor discarding it. The larva lay in the retreat some five days, when it was removed by the writer. The spider continued to present a normal adult appearance, with abdomen somewhat distended, but remained in

retreat, in the normal resting posture. On December 29 the remains of the orb and its main supports were removed, leaving only the retreat platform under which the spider continued to rest, no new construction being attempted.

On January 3 effort was made to offer water, placing in the retreat a saturated bit of absorbent paper. The spider was disturbed by this maneuver, and moved away from the retreat some 12 inches, travelling about within this radius, resting for some time at the meeting-place of the beam, wall, and ceiling, but was after some hours again observed in the retreat. The paper was removed; it is not known if any water was consumed. More water was offered the next night but the spider was again disturbed, and it is likely that none was taken. The morning of January 5 she was found lying on the floor, on her back, the legs closely folded. Would ordinarily have been taken for dead but this is not the normal death posture of spiders, and on touching, the legs became active. She had apparently fallen from the nest (a distance of some eight feet) and been immobilized by the shock, as noted elsewhere for this genus (6, pp. 5-6). She was replaced in the nest, behavior being not greatly underactive, and thereafter moved briefly about through perhaps four inches radius. During the rest of the day she was observed hanging, rather limply, a few inches outside the retreat. When seen the next day she had again fallen to the floor, and was dead, lying partly on one side. The abdomen had ruptured on striking the floor. As no such injury had been sustained in the previous fall and the creature was then observed in a normal alighting position, it is likely that this earlier descent was modified by thread paid out from the spinnerets, and that the creature was dead when falling for the second time.

#### DISCUSSION

How this individual came into surroundings so abnormal for the species, is a matter for conjecture only. Just before she was observed, the house had been unoccupied for a week, and considerable baggage had been brought by automobile from North Chatham, N. H. It could have been concealed therein, but *E. insularis* as observed in that part of New Hampshire differs markedly in appearance from this individual. Also it should hardly in this case bear such marks of starvation (or dehydration) as appear to have been present. As pointed out by Comstock (2, *Aranea gigas*) this species is noted for varied abdominal markings, though it is questionable to what extent these are of racial or environmental determination. Distinctive dorsum patterns, noted by the present writer, are included in Table 1.

TABLE 1

"Race"	Predominant color	Predominant markings	Where especially observed	Remarks
A	Medium grayish brown	Same, lighter	North Chatham, N. H., under dark caves	Man-made supports unusual for this species; adaptive coloration?
B	Bright yellow	Light	Hopkinton, Mass., 3'-4' shrubbery, in open	Adaptive coloration?
C	Very dark brown	Much lighter	North Chatham, N. H., 3'-4' shrubbery, somewhat shaded	Very small bodied; in a restricted locality only; distinctive "drooping" behavior
D	Medium brown	Light	Hopkinton, Mass., as in B	Suggests an autumn phase of B; sometimes approaches plum color of <i>E. trifolium</i>
E	Yellow	Very dark	Hopkinton, Mass., 4'-6' shrubbery	Habit relatively aggressive

The above makes no claim to completeness, even for readily observed body-types. The individual here recounted came closer to Comstock's *Aranea gigas conspicellata* than to any of the above; these are not uncommon in the writer's chief observation ground (in Hopkinton, Mass.) but he has not happened to see them nearer his domicile. In any case the habits of the species make it very unlikely that it would come into a suburban house of its own accord. The balance of probability is that it was unknowingly brought from Hopkinton not less than a week earlier, and had established itself in the house during the absence of the usual human occupants.

Emerton (3, p. xvi) stresses the need of supplying water to captive spiders, but this probably assumes that they are not given their natural food. It is relevant that at least two species locally common, *E. cavatica* and *T. tepidarium*, also certain agalenids, build largely indoors, where no water in the ordinary sense ever reaches them, save through the body-fluids of their captures. On the other hand, *E. insularis* is a species which the writer has never otherwise observed to nest indoors. Also it favors the proximity of bodies of water, and might thus be less resistant to dehydration than the indoor species. In the spring of 1938 two *C. conicas* escaped from confinement in the house, where they had been brought for experimental study, and their nests were later located within the house. One of these nested close to the writer's desk, together with another not escaped, and these two were kept under observation for some days, fed with freshly killed insects. The other was found some three weeks after escape, having built a nest in the attic, remote from any possible food or water; its appearance and behavior were normal though of course it had not grown like the others. *C. conica* is another outdoor species, though it is less partial than *E. insularis* to damp surroundings. The two domesticated *C. Conicas* showed little need for any water offered them as such, apparently deriving sufficient from the insects fed them; the other had apparently not suffered in vitality from its relatively long deprivation (cf. the tarantula). In the present *E. insularis*, a sufficiency of water seems also to have been afforded by the insect offerings; there was no known utilization of the water offered towards the end, though the creature was still reasonably active.

The spider hardly attained more than two-thirds the size seen in full-grown, gravid individuals of her species, during October; neither did she spin a cocoon. The probability is that she came into the house before the mating season and thus remained unmated, whatever effect this may have on the spinning of a cocoon; no deposition of eggs was observed.

An exhaustive study of capturing behavior in *E. diademata* has been reported by Peters (4, 5) and characteristic differences in the

capturing patterns of common genera are readily observed. Thus it is found that the *Argiopes* depend more on wrapping, the *Epeiras* more on biting; the former are actually the better spinners, the bite of the latter is more toxic, at least for ordinary prey. If not a usual, it is at least an occasional practice for the commoner local *Epeiras* to give an initial bite to the prey before wrapping it. In the present individual an initial bite was never observed, but the food although dead when put in the nest, was more liberally wrapped than is usual with this species. The point is of interest with regard to reflex mechanisms involved. In *A. aurantia*, wrapping seems to some extent response to struggles of prey but this could not be the case here (possibly chemical reflexes, cf. Peters) or in instances where the present writer has observed other species to wrap and suck bits of raw meat, or water-soaked scraps of paper. It is response to immediate movements of prey that is here in question; without these it appears normally necessary to attract the spider with a vibrating fork. Immediate movement should be at least a contributory stimulus to initial bite (cf. Peters); both were here absent.

Save at the very first, the present spider had to be directed to the food as above, by touching the food or neighboring strands with a vibrating tuning fork. Barrows' (1) early observations on this point seem otherwise well established, and are confirmed in the present instance. Food was usually but not invariably taken to the feeding place at the time of capture; the feeding place might be at orb-center or in retreat; on one occasion was observed the unusual instance of apparent feeding at the point of capture. Aside from vibrations or struggles, orb-weavers may ultimately locate a foreign object in the web by differential tensions it produces (or when taking down the web), and then dispose of it according to its nature.

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## A PRESCHOOL FORM OF THE SYMBOLS SCALE\*

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A scale for measuring various early stage abilities in connection with letters and numbers has previously been reported (1). In using the scale with pre-first grade children it was found that much of it was too difficult for many of them and that it consequently failed to produce differences in scores indicative of relative abilities. An easier form of the scales has therefore been devised and this paper reports results from its use.

In order to keep the discussion clear the easier form of the scale has been called the pre-school form and the harder one the primary form. The former is composed of the following ten subtests:

- Subtest 1—Writing (printing) own name.
- " 2—Saying letters from memory (alphabet).
- " 3—Saying the number sequence (1, 2, 3 . . . ).
- " 4—Reading 10 capital letters.
- " 5—Reading 10 small case letters.
- " 6—Reading the 10 digits.
- " 7—Recognizing eight consonant sounds.
- " 8—Writing (printing) 10 capital letters.
- " 9—Writing (printing) 10 small case letters.
- " 10—Writing 10 digits.

Three subtests of the primary form do not appear in the easier scale, namely: giving letter sounds, recognizing vowel short sounds, and giving phonic combinations. Four new subtests appear in the pre-school form, namely: writing name, saying letters from memory, saying numbers, and reading digits.

The scoring values of the subtests of the pre-school form are 10 each, making possible a perfect score of 100. Since the primary form was also scored on the basis of 100 the forms are, for practical purposes, roughly comparable, although the available data do not make possible significant statistical treatment for comparative purposes.

Administration of the pre-school form is, like the other, by individual testing. The order for giving the subtests is as numbered above. Scoring, while according to definite requirements, is of course quite lenient. The

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quality of responses is not considered, except that the answers must be substantially correct. For example, the printed capital *B* is scored full credit if it shows the main features of two parts, roughly placed in correct position. If, however the letter form is reversed it is given one-half credit, on the principle that the reversal form is better than no response at all, but not even roughly a correct one. Similarly, other gross errors in responses that are partly right were given penalties of one-half credit in scoring.

For Subtest 1 a score of one was given for every letter printed or written correctly up to a total of 10. If a child's first and last names together had fewer than 10 letters he was given full credit if he had all the letters correct.

In Subtest 2 children were asked if they could "Say the alphabet," or the "*A, B, C's*"; or if they knew any letters, from memory, at all. An increasing amount of credit up to 10, according to a table, was given for an increasing number of letters named. No credit was given for the letters *A, B, and C*.

In Subtest 3 the children were asked to count out loud if they could and credit was given up to a maximum of 10, if they could say without error the numbers as far as 50, or less than 10 according to a scale based upon the amount of counting done.

For Subtest 6 a card was used, upon which the 10 digits were arranged in a column in random order. A graduated score up to 10 was given for a varying number of correct or partly correct responses.

The remainder of the subtests of the pre-school form are identical with those in the primary form and were given and scored as explained in the earlier report (1).

The pre-school form was given to 252 kindergarten and first grade pupils in three different schools, as shown in Table 1. The sexes were practically of the same number. The Hunter College Elementary School, because of its convenience, contributed the greater number of pupils. The children of that school were considerably above average in socio-economic status and in mental ability as measured by standard tests. The public school was in a somewhat under-privileged community. The private school represented more nearly an average group of children.

Average scores made on the pre-school form by these children are given in Table 2, by school and grade. For comparative purposes scores made by the same groups of children on the primary form are also shown. At the bottom of the table are given averages for combined groups by grades. Any of these averages may be used as tentative norms, according to what comparisons one may wish to make.

TABLE 1  
DISTRIBUTION OF PUPILS TESTED BY SEX, SCHOOL, AND GRADE

	Boys	Girls	Total
<i>Hunter College Elementary School</i>			
Kindergarten	34	45	79
IA	32	30	62
IB	14	14	28
<i>Private School, Kindergarten</i>	16	22	38
<i>Public School</i>			
IA	15	30	45
IB	31	22	53*
Total	142	163	305

\*Not given the Pre-School Form tests.

TABLE 2  
AVERAGE SCORES ON PRE-SCHOOL AND PRIMARY FORMS IN PERCENTAGES

	Number	Pre-School	Primary	Horace Mann
<i>Hunter College Elementary School</i>				
Kindergarten	79	55	29	29*
IA	62	71	41	32**
IB	28	86	58	58**
<i>Private School, Kindergarten</i>	38	12	4	
<i>Public School</i>				
IA	45	54	28 (N = 27)	
IB	53		45	
<i>Combined Grades</i>				
Kindergarten	117	41	21	
IA	107	62	26 (N = 89)	
IB	81	—	51	

\*One group.

\*\*Three groups.

The averages showed for every school increasing scores for each half-year grade, as would be expected from the nature of the tests and the character of the groups. They also showed that the more favored group of children scored about one-half a year higher than the public school children at each grade level on both forms.

Results from the primary form test given to pupils in the Horace Mann School are also shown in Table 2. The averages for the kindergarten and grade *IB* groups of both the Horace Mann and the Hunter College Elementary Schools were, by somewhat odd coincidence, exactly the same. The averages for the *IA* groups differed somewhat. The general similarity of

these averages may indicate some reliability, but the number of cases involved is too small to be statistically significant. It might be noted in this connection, however, that the tests were given individually and by trained examiners.

TABLE 3  
CORRELATIONS OF THE NEW PART\* OF THE PRE-SCHOOL FORM WITH THE  
TOTAL SCORES OF THE PRE-SCHOOL FORM, THE PRIMARY FORM  
AND READING ACHIEVEMENT SCORES

	Number	Pre-School total	Primary total	Reading achievement
<i>Hunter College Elem. School</i>				
<i>Kindergarten</i>				
Spring 1939	20	.96	.85	.62 (12/39)
Fall 1940	26	.91	.84	
Spring 1940	14	.65	.52	(.60 (1/41) (.73 (2/41) (.67 (6/41)
IA Fall 1940	26	.72	.55	(.63 (1/41) (.45 (2/41) (.62 (6/41)
<i>Public School</i>				
Grade I	23	.79	.83	.61

\*Four subtests, Nos. 1, 2, 3, 6 as in list of subtests.

Table 3 gives correlations indicating something further as to the reliability of the scales as indicators of progress in the early stages of reading. Coefficients of correlation were computed to show the relationships between the four new parts of the symbols scales used in the pre-school form and three other measures, viz.: the pre-school form total score, the primary form total score, and objective measures of reading achievement. The correlations are given separately by the various class groups. Coefficients of correlation are more significant if found in homogeneous groups, as heterogeneity may of itself produce spuriously high coefficients.

The table shows that most of the correlations were at least fairly high. Most interesting of all is the fact that out of eight correlations with reading achievement, seven ranged from .60 to .73, indicating a probable important relationship between the abilities measured by the four new subtests and early reading progress.

Table 4 shows additional correlations. Part (a) contains coefficients obtained for the pre-school form total when correlated with three other measures: the primary form total, reading achievement scores, and the score on the *Gates Reading Readiness Tests*. Part (b) shows correlations of the primary form with reading achievement and the *Gates Reading Readiness*

TABLE 4  
INTERCORRELATIONS OF PRE-SCHOOL FORM, PRIMARY FORM, READING ACHIEVEMENT  
AND READING READINESS TESTS

	Number	(a) Pre-School Form with		(b) Primary Form with		(c) Reading Readiness with	
		Primary Form	Reading Achievement	Reading Readiness	Reading Achievement	Reading Readiness	Reading Achievement
Public School Grade I	23	.86	.77	.75	.78		
Hunter College Elem. School Kdn. Spr. '39	17				.62 (1/40)		.52 (1/40)
" " Fall '40	20	.92	.60	.81	.56	.77	.45
" " Spr. '40	26	.97					
	14	.94	(.46 (1/41)	.57	(.50 (1/41)	.66	(.73
			(.74 (2/41)		(.73 (2/41)		(.77
			(.68 (6/41)		(.64 (6/41)		(.54
IA Fall '40	26	.73	(.55 (1/41)	.75	(.58 (1/41)	.63	(.60
			(.65 (2/41)		(.62 (2/41)		(.69
			(.57 (6/41)		(.50 (6/41)		(.62
Private School Kdn. Fall '39	25				(.66 (10/40)		
Averages		.88	.63	.72	.62	.69	.62

*Tests.* Most of these coefficients are fairly high. The five showing the correlations between the primary and the pre-school forms indicate a very satisfactory degree of validity for the two forms of the symbols scales.

The rather high correlations between the symbols scales and the Gates *Reading Readiness Tests* are due in part to the fact that three of the five subtests of the Gates tests are, in the main, letter ability tests, which is the ability the symbols scales purport to measure.

Part (c) of the table gives the correlations found between the Gates *Reading Readiness Tests* and the reading achievement tests. These coefficients show a little more variation than the others, but on the whole indicate fairly close relationships.

One more piece of evidence points to the probability that the abilities measured by the pre-school form of the symbols scales were not functions of chronological age, but of early beginnings in learning to read. To eliminate spurious relationships due to a wide spread of ages correlations were computed for one grade group only between the 10 subtests of the pre-school form and chronological age. The coefficients ranged from  $-.07$  to  $.27$  and the total scale score gave a correlation of  $.10$ .

The usefulness of the pre-school form of the symbols scales is much the same as that for the primary form. This has been discussed in the reference

cited above (1). Briefly, the test may be used diagnostically as a basis for guidance in early stages of reading, especially for correction of errors and part learnings, indication of immediate needs in new learnings, and perhaps for tentative class groupings. The reference also makes suggestions as to how to help children develop letter abilities which will contribute to their mastering the mechanics of reading.

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## EMANCIPATION STATUS OF COLLEGE STUDENTS\*<sup>1</sup>

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One of the major problems of the adolescent is the breaking away from the parents. This does not necessarily result in the person leaving home, but it does necessitate his becoming psychologically free from the parents. The purpose of this study was twofold: to develop a questionnaire that would be suitable for measuring the emancipation status of older adolescents, and to study certain factors which were believed to be related to the emancipation status.

The process of outgrowing parental domination has by some writers been termed "psychological weaning," and by others "emancipation." Both terms are useful and those who use them seem to be aware of their different meanings. According to Conklin (6), "those who prefer to use the term emancipation appear to be thinking almost exclusively of the progressive change in the habits of the growing individual." He states further that "a full consideration of all factors involved in the course of normal adolescent emancipation reveals that there is a parallel change in the habits and attitudes of the parents as well." Hence, Conklin believes that when one is considering the changes which are taking place both in the child and in the parents, the term psychological weaning is more appropriate.

That the adolescent should be psychologically weaned from his parents is agreed upon by all persons who have written about this subject. The unhappiness which comes sooner or later to the unemancipated person is recognized by authors of both fact and fiction.<sup>2</sup> It is biologically inevitable that both parents will die sooner or later. The person who has become attached to one or both parents to such a degree that he or she cannot carry on the normal personal and social aspects of life will experience a shock when the parents die. Another reason for the desirability of psychological weaning is found in the environmental differences. The child is a member of a new generation which may be quite different from that in which the

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<sup>2</sup>For a list of references to fiction and biography treating this problem, see Leta S. Hollingworth, *Psychology of the Adolescent*, page 216.

parents were born and molded. The most important reason for being psychologically weaned, according to Mrs. Hollingworth (10), is that the adolescent may be tolerable to people at large who have no special sentiment in regard to him.

That being psychologically weaned from the parents is a gradual process, possibly heightened during adolescence, is agreed upon by most writers. Only a few of the authors, however, have presented suggestions for effecting a normal process of psychological weaning. Mrs. Hollingworth (10) believes that psychological weaning depends largely upon whether the parents have insight into the problem and whether they have helped the child to lay the foundation of successful adolescence in childhood by treating him from infancy as if he belonged to himself and his generation rather than as if he was their personal possession. Zachry (27) also stresses her belief that emancipation is a gradual process when she says: "At all stages of emotional growth the young person seeks to attain status as a less immature person; this striving is an important factor in his development from infancy onward. . . ."

Conklin and others also point out that youth is in conflict over its desire to throw off parental obedience and dependence. Frank writes:<sup>3</sup>

It must, therefore, be reiterated that parents are the chief source of the child's security and his major reliance for reassurance and love and affection. At adolescence the individual boy and girl are attracted to life outside the protecting home; they want to be accepted by their contemporaries, to explore the fascinating world of people and taste the experiences that seem so rich and adult. But their desire to go out to life is not unmingled with a need for continued protection and security; indeed the more they venture out, the more they need to feel they can return home and find help and reassurance.

Parents should be aware of this conflicting desire of the adolescent to be emancipated from the parental control, and should be willing to assist in every way possible. The famous student of adolescence, G. Stanley Hall (9), recognized the failure of many parents to do this when he wrote: "Parents still think of their offspring as mere children, and tighten the rein when they should loosen it. . . . If the training of early years has been good, guidance by command may now safely give way to that by ideals, which are sure to be heroic."

There are certain types of behavior which are frequently associated with defective emancipation. Conklin (6) presents a list of five types of behavior

<sup>3</sup>Lawrence K. Frank, *The Adolescent and the Family*, National Society for the Study of Education Forty-Third Yearbook, Pt. I Adolescence, 1944, page 248.

which he believes might be indicative of the unweaned condition: (*a*) timidity; (*b*) disinclination to go out socially; (*c*) homesickness; (*d*) rebellious, uncoöperative conduct in a youth who is otherwise mature and promising; (*e*) notably selfish outbursts. Mrs. Leta Hollingworth (10) presents as the general symptoms of an unweaned condition: (*a*) asks special consideration from employers; (*b*) occupational drifting; (*c*) tantrums; (*d*) expects spouse to act like a parent; (*e*) refusal to leave the parental home after marriage; (*f*) choice of much older person as a mate; (*g*) expects persons in positions of authority or intimacy to act like parents. Cole (4) classifies the behavior of unemancipated adolescents into two main groups; (*a*) those who constantly seek the advice and help of others because of lack of practice in meeting situations alone; (*b*) those who in order to cover up the social and emotional attachment to home and parents make numerous dramatic overcompensations.

A questionnaire study of emancipation was conducted by Rev. James A. McDill and was reported by Dimock (7). Probably the greatest value of this study was the development of an objective technique for measuring the emancipation status of the adolescent by means of a questionnaire. After the questionnaire had been administered to 168 boys from ages 13 to 16, the authors looked for factors that seemed to be related to the adolescent's emancipation status. As a means of detecting possible association between adolescent emancipation and physical, mental, personality, and socio-economic factors, correlations were run for 14 measures. Although the correlation coefficients between emancipation scores and these other variables were all low, those for physical characteristics were highest. The correlations between emancipation and physical strength, weight, height, and pubescence ranged from  $+.24$  to  $+.19$ . Those for *CA* and *MA* were  $+.14$  and  $+.13$  respectively. Those for moral knowledge and religious opinion were  $+.11$  and  $+.06$ . Acceptability, superiority, feeling of difference, and self criticism were related to emancipation in a negative way with coefficients ranging from  $-.11$  to  $-.16$ . Socio-economic status was essentially unrelated to emancipation ( $+.07$ ). In spite of the low order of these correlations Dimock believed that the more emancipated boys possessed a greater sense of personal adequacy and were better integrated in their attitude toward other boys since they tended to be less self-critical and to have less feeling of difference (i.e., superiority or inferiority) to their contemporaries.

## THE EMANCIPATION QUESTIONNAIRE

Since the McDill Emancipation Scale was designed for boys from 10 to 18 years of age, for the present study it was necessary to construct a new questionnaire that would be suitable for university students of both sexes. Over a period of several months the writer assembled a series of original items in the form of statements, which were intended to indicate whether or not the subject was emancipated from his parents. Since the purpose of the questionnaire was to obtain a single numerical index of the emancipation status, the items were designed and scored with this in mind. Each item was given a score of plus 1 if answered in the manner believed to indicate emancipation and 0 if answered in a way that indicated a lack of emancipation. Question mark responses<sup>4</sup> were also scored 0, since they were not indicative of emancipation or lack of it. Since the questionnaire had 60 items, it would be possible for an individual to make a score anywhere between 0 and 60, the lower score being unfavorable and the higher score being favorable with regard to emancipation. The items of the questionnaire and their scoring are given in Table 1.

TABLE 1  
ITEM ANALYSIS OF EMANCIPATION QUESTIONNAIRE

	Percentage of emancipated responses		
	Most eman. group (106 cases)	Least eman. group (104 cases)	Diff. between groups
1. I write to my mother for suggestions on the clothing I should wear to a formal dance. (No)*	97.1	70.7	26.4
2. I go to church regularly solely because it pleases my parents. (No)	95.1	91.5	3.6
3. I decide what courses I shall pursue without assistance from my parents. (Yes)	86.5	42.5	44.0
4. I often wish that my parents would visit me at the university more frequently. (No)	63.4	16.0	47.4
5. I plan my daily schedule without assistance from my parents. (Yes)	9.7	9.5	0.2
6. When I was in high school I usually depended upon my parents to help me with my home work. (No)	100.0	94.3	5.7
7. A considerable part of my conversation with friends is concerned with my home life and my parents. (No)	91.3	34.9	56.4

<sup>4</sup>Except in three cases; Items 9, 38, and 47, in which the question mark was scored because it was designated as a method or response for those items.

\*Answer in parenthesis is indication of emancipation.

TABLE 1 (*continued*)

	Percentage of emancipated responses		
	Most eman. group (106 cases)	Least eman. group (104 cases)	Diff. between groups
8. I tell my parents about every date I have. (No)	100.0	56.6	43.4
9. I am sometimes jealous of the attentions my parents show to my brothers and sisters. (If you have no brothers or sisters circle the ?.) (No)	92.3	84.9	7.4
10. I purchase my own clothes without assistance from my parents. (Yes)	68.2	21.6	46.6
11. I receive an allowance of money from home. (No)	41.3	23.5	17.8
12. When writing to my parents, I tell them everything I have done in the past few days. (No)	85.6	33.0	52.6
13. When I am feeling blue I usually look to my parents for comfort. (No)	88.5	16.0	72.5
14. I often wish that my parents were living nearer to the university so that I could see them more frequently. (No)	69.2	27.3	41.9
15. I depend upon my mother or father to send out Christmas cards (or other greetings) for me. (No)	94.2	83.0	11.2
16. When the time comes for me to marry, I shall select my mate without any help from my parents. (Yes)	91.3	52.8	38.5
17. I can stand pain without looking to my parents for words of comfort. (Yes)	94.2	60.3	33.9
18. I am bossed around like a little kid by my parents. (No)	97.1	96.2	0.9
19. When letters come from my parents and friends, I open the letters from my friends first. (Yes)	20.2	7.5	12.7
20. I tell my mother what I do and how I feel. (No)	56.7	7.5	49.2
21. Even though I could afford to live elsewhere after graduation from the university, I would prefer to live at home. (No)	84.6	31.1	53.5
22. I do what my mother or father decides on every question that comes up. (No)	98.0	74.5	23.5
23. I am shy with members of the opposite sex of my age. (No)	80.8	77.3	3.5
24. I work to get my spending money, or to help with the family expenses, or both. (Yes)	59.6	26.4	33.2
25. I depend upon my parents to buy all my things for me. (No)	86.5	49.0	37.5
26. When I am feeling ill, I call my mother and ask her what I should do. (No)	97.1	84.9	12.2
27. I get people to sympathize with my hurts or troubles. (No)	82.7	52.8	29.9

TABLE 1 (*continued*)

	Percentage of emancipated responses		
	Most eman. group (106 cases)	Least eman. group (104 cases)	Diff. between groups
28. I would be happy and satisfied in spending one of the shorter vacation periods at the home of a friend. (Yes)	67.3	28.3	39.0
29. When writing to my parents I tell them about the feelings that I have. (No)	75.0	24.5	50.5
30. I think more of what my friends say than of what my parents say. (Yes)	80.8	1.8	79.0
31. I am told by my parents that I am not old enough to do the things I want. (No)	91.3	75.4	15.9
32. I take into consideration my parents' wishes when selecting my friends. (No)	60.6	15.0	45.6
33. I ask assistance from my parents on how to use my spending money. (No)	100.0	74.5	25.5
34. Since coming to the university I believe that I have been as happy as most of my friends here at the university. (Yes)	90.4	84.9	5.5
35. I am planning to enter the occupation which my parents think will be best suited for me. (No)	71.1	30.1	41.0
36. When I am in difficulty I usually call upon my parents to help me out of the trouble. (No)	86.5	33.9	52.6
37. I often wish that my parents would write to me more frequently. (No)	58.7	29.2	29.5
38. I drink liquor moderately even though my parents do not approve of my drinking. (If they do approve of your drinking, or you do not care to drink, circle the ?.) (Yes)	90.4	82.0	8.4
39. I do what I believe to be right in most situations even though I am sure that my parents would not approve of my choices. (Yes)	74.0	41.5	32.5
40. I ask my parents to assist me in solving most of my personal problems. (No)	96.1	62.2	33.9
41. I am told by my parents what is right and wrong. (No)	67.3	33.0	34.3
42. There is more than one family picture in my room at the university. (No)	92.3	73.5	18.8
43. I depend upon my parents to straighten out any difficulties that I may have with professors. (No)	100.0	97.1	2.9
44. If a position of equal rank and opportunity were offered to me, I would prefer to work for my father (under the same conditions), than accept the position with a strange company. (No)	76.0	49.0	27.0
45. I am planning to enter the same occupation as that in which my father is engaged. (No)	90.4	78.3	12.1

TABLE 1 (*continued*)

	Percentage of emancipated responses		
	Most eman. group (106 cases)	Least eman. group (104 cases)	Diff. between groups
46. I do not believe that I could travel any great distance if it required me to be away from home or my parents more than a month or six weeks at a time. (No)	95.2	83.0	12.2
47. I smoke moderately even though my parents do not approve of it. (If they do approve, or you do not care to smoke, circle the ?.) (Yes)	89.4†	91.5†	2.1†
48. I enjoy (or would enjoy) traveling in the summer even though it means being away from my parents. (Yes)	100.0	82.0	18.0
49. When writing to my parents I tell them about most everything I have thought. (No)	91.8	49.0	42.8
50. When I am home I have feelings of loneliness. (Yes)	21.2	9.4	11.8
51. I telephone home frequently (or wish that I could) just to hear my parents' voices. (No)	95.2	44.3	50.9
52. I often wish that my parents were here at the university so that I might discuss my problems with them. (No)	82.7	33.0	49.7
53. I frequently ask my mother and/or father to do little tasks for me that I could just as well do myself. (No)	79.8	38.6	41.2
54. I often daydream about my mother and father. (No)	95.2	38.6	56.6
55. In general, life is as pleasant for me here at the university as it is when I am at home. (Yes)	87.5	61.3	26.2
56. I frequently think about my mother and father. (No)	32.7	1.9	30.8
57. While I am home for a vacation I spend nearly all of the time with my parents. (No)	80.8	38.6	42.2
58. I depend upon my mother and father to help me choose the persons with whom I am to associate. (No)	96.2	83.0	13.2
59. After being with my parents for a vacation period, I find it very difficult to leave them. (No)	93.3	34.9	58.4
60. I sometimes wish that I were a child again so that I would receive more attention from my parents. (No)	97.1	80.1	17.0

†Item 47 was the only item that had a reversal in the response for the two groups. It will be noted that the difference is not great.

## THE GROUP STUDIED

Since the object was to study relationships with parents it was necessary to set up three criteria for the selection of subjects: that the student should be unmarried, that he should not be living with his parents while attending the university, and that he should have grown to maturity in a home which included the presence of both parents. The questionnaire was presented to 585 university students enrolled in classes in psychology and sociology. After those not meeting the three criteria mentioned above were eliminated, 438 cases remained, of whom 238 were men and 200 were women. They ranged in age from 17 to 24 years, the majority being under 20.

The emancipation scores for the 438 cases range from 17 (least emancipated) to 58 (most emancipated) out of a possible total score of 60. The mean score for the group is  $40.21 \pm 6.82$ . The distribution of scores approximates a normal distribution closely enough to warrant the use of certain statistical techniques which presuppose a normal distribution.

The reliability coefficient of the 438 cases was computed for the entire questionnaire of 60 items by splitting the questionnaire into halves on the basis of odd and even numbered items. It was believed that this would yield two random groups of items. The coefficient of correlation with the Spearman-Brown correction formula applied was found to be  $+.82 \pm .02$ . This figure is not to be interpreted as unusually high, since coefficients of reliability estimated in this manner are likely to be spuriously high.

The criterion of internal consistency, as described by Thurstone and Thurstone (23), was applied to the questionnaire to determine which of the items were diagnostic. Of this method the Thurstones state that they "consider (it) to be more essential in establishing the validity of the schedule than correlations with the available outside criteria." In this case, no suitable outside criteria were available.

The upper 106 cases (about 25 per cent) based on total emancipation score was used as a group to be compared by items with the lower 104 cases (about 25 per cent). This item analysis is presented in Table 1. Although the diagnostic power of the items does vary considerably, the results of the item analysis showed that the experimenter's original assumption of an emancipated response was correct in 59 of the 60 items.<sup>5</sup> Since the number of cases in the two groups was about equal, it was considered satisfactory to use the percentage difference in emancipated responses between the two groups

<sup>5</sup>Item 47 showed that the diagnostic value was reversed. The difference between the upper and lower groups in this case, however, was only 2.1 per cent.

for indicating the diagnostic power of the 59 items. Since only one item out of the 60 was in reverse of the original assumption of an emancipated response, it did not seem worth while to re-score the questionnaires.

#### FACTORS RELATED TO EMANCIPATION

The relation of other variables to emancipation status was studied by comparison of the most and least emancipated groups. Of the variables studied the greatest difference between the two groups was that of sex. The most emancipated group was composed of 72 per cent men and 28 per cent women; whereas the least emancipated group was made up of 32 per cent men and 68 per cent women. The experimenter believed that this difference might be the result of a bias in the items, but after careful study of the items in the questionnaire it was concluded that there was no apparent bias.

The most emancipated group was, on the average, somewhat superior in intelligence to the least emancipated as measured by percentile scores on the *A.C.E.* examination. This group also was, on the average, approximately seven months older and had been away from home three and a half semesters whereas the least emancipated had been away from home less than three semesters. The difference in intelligence met the usual statistical criterion for significance; those for age and length of college residence almost met it. Socio-economic status was measured by a modification of the Sims scale but the slightly lower average in socio-economic score for the emancipated group was not statistically significant.

Some indication that sibling relationships warrant further study in connection with this problem is offered by the fact that 22 per cent of the least emancipated group were only children whereas only 12 per cent of the most emancipated group had no siblings. It is also possible that Jewish family culture may retard the emancipation process. Ten per cent of the least emancipated were Jewish whereas only three per cent of the most emancipated were Jewish.

In view of the meagre relationship found in this study between emancipation status and such factors as age, length of residence in a college community, and socio-economic status it would seem that future studies of this problem might more profitably be concerned with the relationship of the child to the parents and to their methods of control. It is not sufficient to study the emancipation process alone; one must study the interacting personalities of both parents and child in order to understand the process of psychological weaning and the achievement of emancipation from the parents by the young adult.

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## AUDITORY CHANGES IN CHILDREN FROM AGES TEN TO EIGHTEEN\*<sup>1</sup>

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A review of the literature shows that there is a general improvement in hearing with age, although the age at which the maximum acuity is reached has not been well established. A slight sex difference has also been described in children but there is little agreement among the various workers as to the exact nature of this difference. From this review it was found that the ages between 10 and 18 were probably the most important in the auditory history of the individual in both acuity and sex differences. This study was set up to clarify some of the problems which present themselves in this age range.

Bryant (3) in 1907 reported that auditory acuity reached a maximum at adolescence, but he did not describe the methods used in this work. Bezold (2) showed that children had higher acuity in hearing than adults and that there was a sex difference at the older ages. With the development of better testing procedures the conclusions of these early workers were expanded and verified. Lauer (7) in 1928 studied nearly 5,000 grade and high school children and was able to show that children over 12 years of age generally had better hearing acuity than did those under 12. Chayer's (4) study reports similar results. She found that 11 per cent of the third-graders showed impaired hearing as compared with 7 per cent in the upper elementary years and only 4.5 percent of the junior high school pupils. Sterling and Bell (8) tested 710 children who ranged in age from 8 to 17 years and found an increase in acuity with age. They also found that boys below 11 or 12 were superior in acuity to girls, but that after this age the reverse was true. Cicco and Palmer (5) reported a five-year longitudinal study in which they studied children with slight hearing deficiencies as well as normal subjects. They discovered that with increasing age the defects decreased, and also found a statistically significant difference

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<sup>1</sup>From the Mooseheart Laboratory for Child Research, Mooseheart, Illinois. The problem was originally suggested in conversation with the late Dr. C. C. Bunch, Northwestern University School of Speech. The writers wish to extend their thanks to Dr. Harold J. Noyes, Professor of Orthodontics, Dental School, Northwestern University, for the estimation of skeletal ages from X-rays, using the Todd Standards.

in sex as related to high tone loss—the boys showing a greater loss than the girls. Beasley (1) found that children under 10 were significantly lower in acuity than were the 10 to 19 year group. This was true only in the case of air conduction; bone conduction did not show the same trend. Kennedy (6), in a recent study in which she related auditory acuity to reading problems, found essentially the same results as reported above.

The present study was undertaken in order to find at least tentative answers to the following questions: (a) At what age does auditory acuity reach a maximum? (b) Are there any sex differences in auditory acuity and, if so, does pubescence accentuate these differences? (c) Does a relationship exist between auditory and developmental level and, if so, is skeletal age a better index than chronological age?

The subjects used were all children of the Mooseheart Community. Since they came from all regions of the country, both rural and urban, they represent a fairly good cross-section of the child population of the nation,—173 subjects being used altogether; nine or ten children of each sex for each year of age from 10 to 18. Each child was tested as close to his birthday as possible. A further grouping was made to study the effect of pubescence: The pre-pubertal group (Group I) consisting of 30 boys and 28 girls in the age range 10 to 12; the pubertal group (Group II) consisting of 28 boys and 29 girls in the age range 13 to 15; the post-pubertal group (Group III) consisting of 29 boys and 29 girls in the age range 16 to 18. Approximately the same age groupings were made independently for the skeletal age assessments (54-57). Our results are reported in terms of these six groupings.

The Sonotone Audiometer (Model 1) was used to determine the auditory threshold. Eleven frequencies were tested from 128 to 16,000 double vibrations with an intensity range from—20 db. to 75 db. The interrupter was used throughout the testing to insure reliability of answer. Both ascending and descending thresholds were established. Air conduction only was used. A reliability estimate was obtained for 55 of the 173 cases; the reliability coefficients for the low tones (those below 1,000) were between .35 and .43 and for the higher ones between .68 and .85. These correlations are lower than those reported by Kennedy (6) but show the same trend.

## RESULTS

1. In general it was found that the acuity for the middle tones, those from 1,024 to 8,192 was superior to either the lower or higher ranges for all groups. By far the greatest acuity was found for the two tones 2,040 and 4,096.

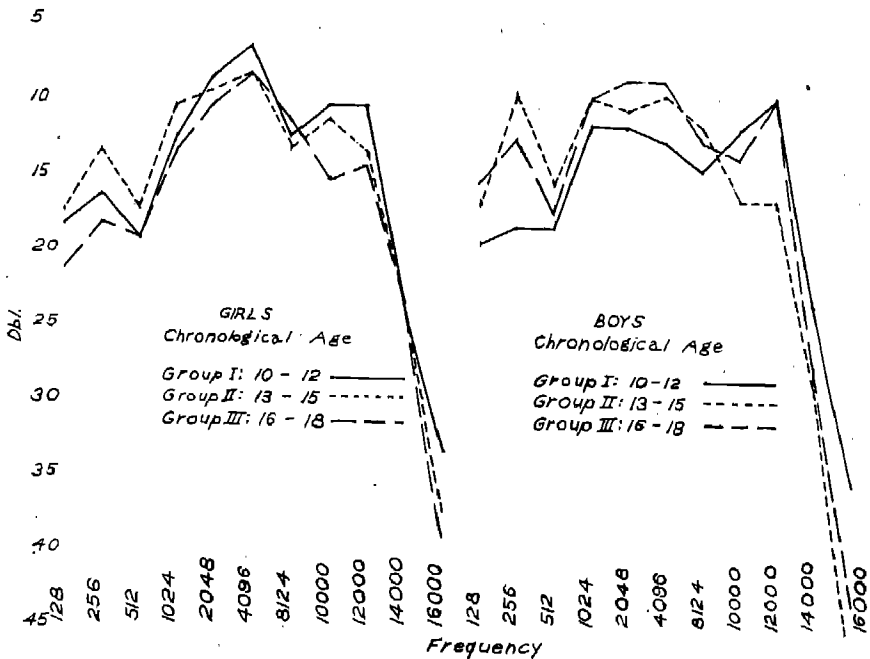


FIGURE 1  
AGE DIFFERENCES

2. The effect of age, and especially of pubescence, is demonstrated in Figure 1. It should be noted that the girls show very little difference between the three groups which indicates that very few changes occur in auditory acuity between the ages of ten and eighteen for girls, except for the slight loss in the ability to hear the lower tones.

The boys, on the other hand, show statistically significant differences with increasing age. The largest number of significant differences is between the pre-pubescent and pubescent groups as is shown in Figure 1. The acuity for all three low tones is greater for the pubescent group than the pre-pubescent group. There is a decrease in the acuity for the high tones. In comparing the pubescent group with the post-pubescent group, there are only slight differences which indicate that the greatest change occurs at the pubescent period.

3. The sex differences are demonstrated strikingly in Figures 3 and 4. Table 1 presents the same material with the statistical reliabilities. It

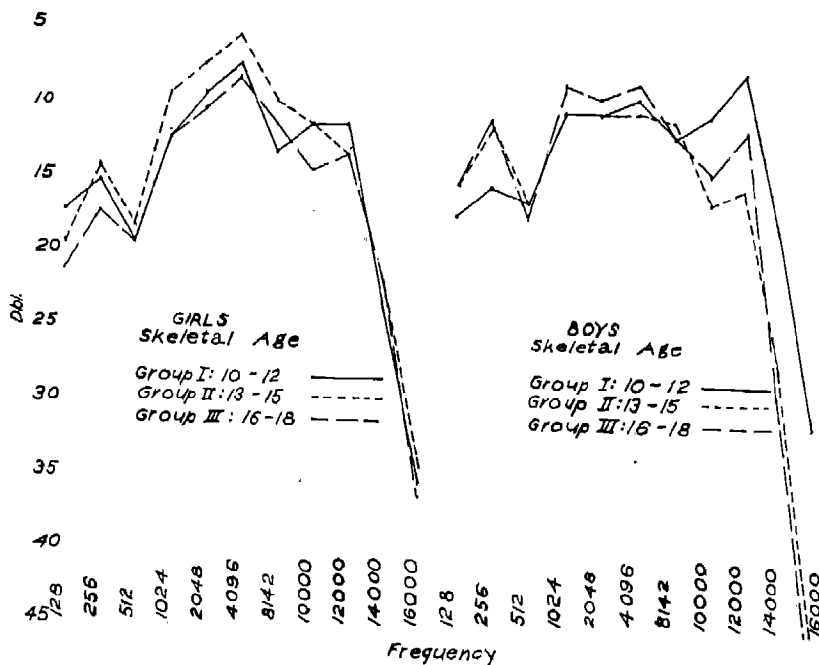
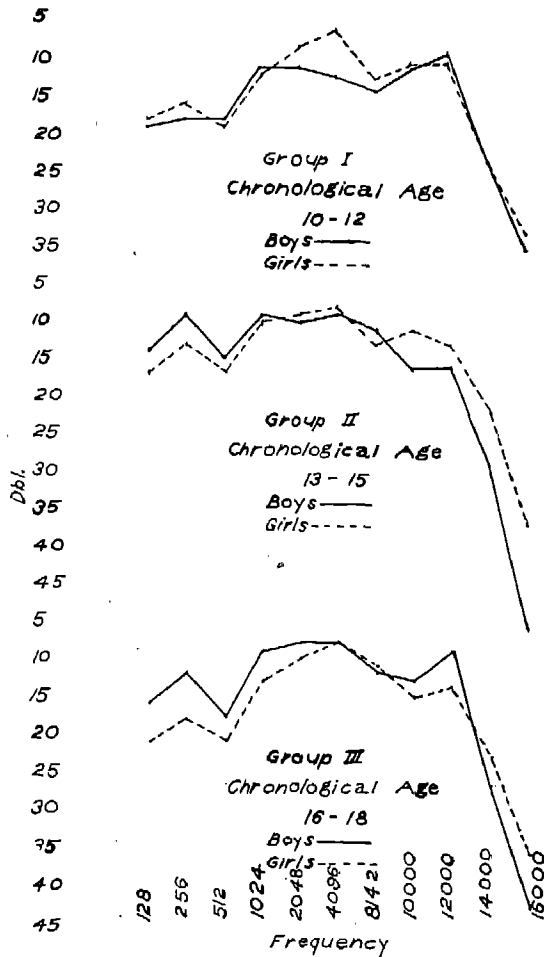


FIGURE 2  
AGE DIFFERENCES

should be noted that in the pre-pubertal group the two sexes hear about the same, except that the girls are slightly better in the ability to hear the middle tones. At puberty a statistically significant difference is demonstrated in the ability to hear the high and low tones. The boys hear the low tones better and show less acuity for the high ones than do the girls. This difference is primarily due to the change in the boys. It was shown in Figure 1 that the girls change very little in auditory acuity with age. The difference is most notable in the pubescent group but carries over into the post-pubertal period.

4. When the groupings were on the basis of skeletal age, the results (presented in Figure 2 and Table 1) were essentially the same as those for the chronological age groupings. A statistical comparison was made between the results for groupings according to the skeletal age criterion of maturity and the chronological age criterion *within* age groups and *within* sex groups, i.e., the results for chronologically determined Group I were



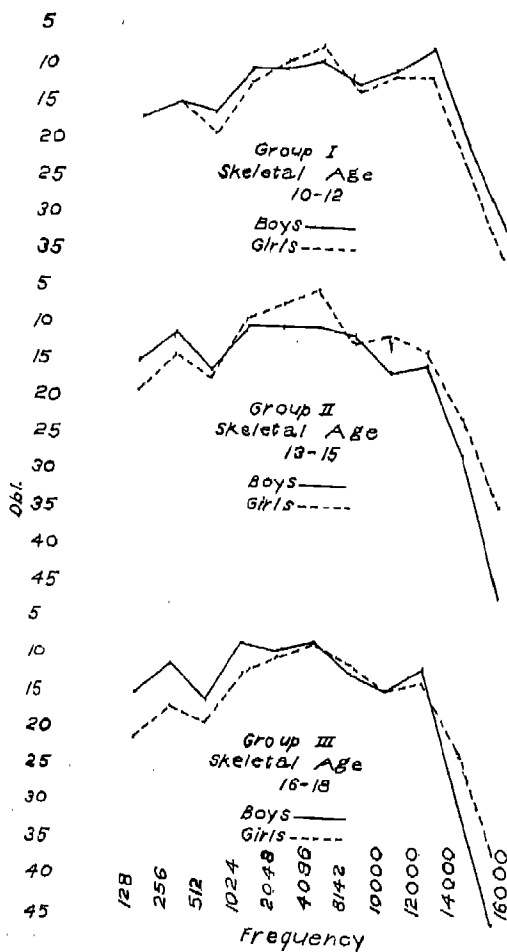


FIGURE 4  
SEX DIFFERENCES

age from those determined by skeletal age. The correlation between the chronological age and the skeletal age determinations were .90 for the boys and .80 for the girls.

#### CONCLUSIONS

(a) Auditory acuity apparently reaches a maximum at the pubescent period, ages 13-15 inclusive. (b) At pubescence the boys are able to hear the low

TABLE 1  
SIGNIFICANT SEX DIFFERENCES BY FREQUENCIES

Freq.	Mean dbl. of male	Mean dbl. of female	Level of sig.	Mean dbl. of male	Mean dbl. female	Level sig.	
<i>Prepubertal Group I.C.A.</i>				<i>Prepubertal Group I.S.A.</i>			
2,048	11.4	7.9	.05	No significant diff.			
4,096	12.4	6.0	.01				
<i>Pubertal Group II</i>				<i>Pubertal Group II</i>			
14,000	28.8	22.7	.05	10,000	15.7	10.7	.05
16,000	51.1	37.2	.01	16,000	45.7	34.1	.05
128	13.9	17.3	.05				
256	8.9	12.8	.05				
<i>Post-Pubertal Group III</i>				<i>Post-Pubertal Group III</i>			
1,024	9.0	13.0	.05	16,000	46.3	36.3	.01
14,000	26.6	22.5	.01	128	15.4	20.6	.01
128	15.5	21.4	.01	256	10.6	17.9	.01
256	12.0	17.7	.01				

tones better than the girls, but have a lower acuity for the high ones. This difference is due almost entirely to the change which occurs in the boys since the girls auditory acuity is relatively constant with age. (c) For the purposes of this study, skeletal age groupings gave essentially the same results as did chronological age groupings.

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## THE INVARIABILITY OF CERTAIN COEFFICIENTS OF CORRELATION DURING HUMAN DEVELOPMENT\*

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Most psychologists agree in the idea that child psychology should be approached as well from the genetic (developmental) as from the cross-sectional point of view, both of which must be joined in one or the other way, difficult though such task may be. The developmental standpoint is characterized by the interest in the changes of the behavior, the capacities and interests of the child as he grows. The student observes and determines the progress in each of his different physical traits, motor capacities, performances and behavior patterns, trying to discover their rules and norms. As a matter of fact, these different lines of development are the main object of the research work which has been done in child psychology. The chapters of the Manuals and textbooks are principally concerned with the growth of the sensory and motor functions, the intellectual and emotional changes, the stages in learning to speak, draw, and work, in following up the play interests and the progress of social adjustments, etc.

As to the meaning of what is the cross-sectional point of view, there exists a certain disagreement. Morgan (4, pp. 17/18) says: The student who chooses the cross-sectional approach, "sees groups of children of different levels and is interested in comparisons between them. From studies of great numbers of children he sets norms, and he sees the individual in comparison with standards derived from studies of other children. . . . The cross-section gives us norms by means of which we can judge the progress of the individual child." It seems, then, that this point of view is little more than the application of the general genetic approach to the individual.

But there exists also an entirely different concept of cross-section which is much more important. According to it, the essential problems concern the internal relationship between the various phases of development and the organization of the many functions, qualities, and behavior patterns of the child, be it the individual or the average child as representant of a group. Brooks sees this point when he says: "Some traits are closely related in their

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development, others are more loosely associated. Only by considering the traits together can a picture of the whole child be obtained" (3, p. 511). This problem, the problem of the organization of traits, has been approached principally by the computation of the coefficients of correlation between many kinds of achievements, the perceptual, motor, intellectual, etc., in children of different ages, sexes, classes, and races under many varying conditions. But the enormous amount of results which exist scattered over the psychological literature, hardly ever has been critically reviewed and synthesized in a systematic way. If Brooks admits that "unfortunately our knowledge is limited concerning the interrelationship of one very important class of traits, the characteristics of personality," we dare say that the lack of our knowledge is unfortunately much larger, particularly with respect to the synthesis and the interpretation of the bare facts.

But a still more deplorable shortage exists concerning the coupling and union of both aspects, the developmental and the cross-sectional point of view. As a matter of fact, occasional observations about such mutual influences are often to be found. Nobody doubts that the development of one "trait" cannot be fully appreciated without taking into account the manifold influences which other factors may have upon its formation, and the effects which its development will bring about upon other factors. Such cross-connections have been seen by many psychologists. Postural control of the infant precedes necessarily the first efforts of locomotion. A certain amount of sensorial experiences is indispensable before remembrance, abstraction, and generalization are possible. We cannot expect a child to be afraid of a serpent before he has had shock experiences or learned an effective warning with respect to such animals, etc. And likewise, it is obvious that later acquirements can and will reflect upon former habits and already established behavior patterns. Memory traces may have an influence upon later observations and actions. The difficult problem of the interaction between maturation and learning is intimately related with these questions; the necessity of an exact and systematic investigation of them needs not to be emphasized.

There exists a close concatenation between these problems and that of the "differentiation" and the "integration" of the physical and psychical functions, that is to say, of the *process* of "organization" of the traits. Not only the fact, but the manner and the degree of intimacy in which thinking is becoming connected with speaking, voluntary actions with the "time-perspective," observation with imagination, the different social and moral qualities with each other, and how such relations change the structure of mind, these

are some few of the innumerable problems which, to the writer's knowledge, seldom if ever have been advanced.<sup>1</sup>

And finally we have to consider the problem as to the variability of the "organization" of the different traits and factors which constitute the personality in its development. It is a primitive way to approach this question which we propose in the following lines. Our problem may be put in this form:

*Do the intercorrelations between certain measures and tests change during the development of the human being? And if they do, will the coefficients of correlation increase or diminish?*

#### A. PHYSICAL TRAITS

Amongst the few investigations concerned with the relationship of some physical traits, which we have found useful for our purpose, we may refer to Baldwin's observations. We cite without any omission all the values contained in the literature at our disposal (3, p. 513), presenting them in a slightly different way in order to show clearly the changes of the coefficients of correlation with the progress of age in both sexes, as will be seen from Table 1.

The differences between the means of the values for the two age groups of each sex are of course insignificant; the differences between the sexes are more remarkable, but the two critical ratios corresponding to the two age groups are not significant either (2.30 and 2.46 respectively). And if we consider the single pairs, the values are mostly very similar. Only 3 of the 19 pairs concerning the boys and five of those for the girls show relatively large differences. They have been marked in the table with asterisks. The values of *SD* in the last row are relationed with these differences. Small though they are they are essentially enlarged by the values marked with asterisks. Without considering them there would result the values put in parenthesis.

From the table we may conclude that most of the coefficients of correlation between the physical traits considered remain fairly constant during the development of both sexes, in the interval of time taken into account. What does that mean?

There exists a certain probability that those subjects who have for example a larger (or a smaller) height than the average of the same sex will have

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<sup>1</sup>I must apologize if I am wrong. The locally conditioned difficulty of knowing even a slight part of the existing literature can hardly be correctly appreciated by psychologists in the U. S. A.

TABLE 1  
MEAN CORRELATION BETWEEN CERTAIN PHYSICAL TRAITS FOR AGES 7-9 AND AGES 10-12  
(No. 50 TO 60 FOR EACH AGE AND EACH SEX)

Traits	Ages	Boys		Girls	
		7-9	10-12	7-9	10-12
Height—weight		.866	.830	.611	.637
Height—breathing capacity		.800	.757	.546+	.710+
Height—sitting height		.944	.924	.821	.897
Height—chest girth		.665	.670	.547	.487
Height—strength right arm		.593	.583	.670+	.515+
Height—strength left arm		.513	.518	.634+	.451+
Height—strength upper back		.436+	.579+	.495	.448
Weight—breathing capacity		.745	.713	.513	.564
Weight—sitting height		.830	.788	.542+	.652+
Weight—chest girth		.838	.864	.897	.919
Weight—strength right arm		.692	.633	.490	.507
Weight—strength left arm		.615	.583	.451	.514
Weight—strength upper back		.533+	.621+	.430	.384
Breathing capacity—sitting height		.796	.727	.565	.612
Breathing capacity—chest girth		.677	.683	.557	.476
Breathing capacity—strength right arm		.569	.562	.485	.461
Breathing capacity—strength left arm		.529	.485	.470	.434
Breathing capacity—strength upper back		.474+	.603+	.529+	.411+
Strength right and left arm		.822	.764	.827	.812
Means		.681	.678	.578	.573
SD		.149	.114	.127	.147
SD of the differences of the values for each sex		.078	(.035)	.087	(.052)

+Asterisks where the differences between the age groups are relatively high.

also a larger (or a smaller) weight than the average. This probability does not change essentially when the age of the group increases three years. Or put in another way: the probability that the anatomical relation between the height and the weight of the group which is indicated by  $r$ , remains approximately the same during the considered period. And this constancy is valid of practically all the physical traits contemplated by Baldwin.

Much the same result may be derived from the observations recorded by Brooks with respect of the intercorrelations of height and weight of girls from 10 to 15 years of age, as will be seen from Table 2 (3, p. 514).

The coefficients, though definitely higher than those of Baldwin, presented in Table 1, show once more an astonishing constancy, or at least no trend to increase or to diminish with age.

The following investigation refers to the change of the correlations between different mental tests and between different motor tests, each category taken separately.

TABLE 2  
THE INTERCORRELATIONS OF HEIGHT AND WEIGHT OF GIRLS

Age	N	r	r (mean)
10	20	.835	
11	57	.739	
12	20	.845	.781
12	46	.717	
13	57	.797	
13	29	.887	.842
14	46	.704	
15	29	.804	
Mean		.791	
SD		.061 = 7.7%	

### B. MENTAL TRAITS

In 1942, Sardon and the present writer examined some 650 male children of the Lima primary and secondary schools with an adaptation of the Terman Group Test of Mental Ability for Grades 7 to 12, Form A, to the Peruvian situation. The subjects belonged to the IVth and Vth Grade of the primary school (named IVp and Vp) and to the Ist and IInd Grade of the secondary school (named Im and IIm) with ages ranging from 12 to 16 years. The details and the results of that study have been explained in a former publication (2). It has been shown that the general progress in the performance of the test as a whole and in all the subtests was very clearly related with the school progress from grade to grade, as can be seen from Table 3, but at the same time the scores did not reveal any significant improvement in function of the chronological age, as is shown in Table 4. Both tables refer to the test as a whole.

TABLE 3

Grade:	IVp	Vp	Im	IIm
Number of subjects	126	176	156	194
Mean score	28	45	54	78

TABLE 4

Chronological age	(12)	13	14	15	(16)
Number of subjects	68	128	201	152	103
Mean score	(42)	52	53	53	(61)

The apparent progress from 12 to 13 and from 15 to 16 years results because subjects of 12 years of age existed only in the primary schools, and subjects of 16 only in the two grades of the secondary schools. Therefore we have put those values in parenthesis.

The same holds true of the 10 subtests, as is shown in Tables 5 and 6. The conclusion derived from these facts has been that the progress of the pupils is essentially based in the effect of education, and not in the maturation.

TABLE 5

Mean score in subtest	(12)	Age (years)			
		13,	14	15.	(16)
I	(4,7)	6,7	6,1	6,1	(7,0)
II	(4,6)	6,4	5,8	5,8	(6,8)
III	(5,4)	8,1	7,3	6,9	(9,3)
IV	(3,9)	5,7	5,1	4,8	(6,4)
V	(3,0)	4,2	3,5	3,3	(4,2)
VI	(4,0)	5,4	4,9	4,7	(5,4)
VII	(4,0)	5,4	4,6	4,4	(6,2)
VIII	(2,1)	3,0	2,5	2,4	(2,6)
IX	(6,2)	6,7	5,5	6,1	(6,6)
X	(4,2)	4,8	5,0	4,1	(5,6)

TABLE 6

Mean score in subtest	IVp	Grades		
		Vp	Im	IIIm
I	3,4	5,3	6,8	9,3
II	3,3	5,5	6,7	8,3
III	3,6	6,1	8,1	12,0
IV	3,0	4,4	5,8	7,6
V	1,7	3,6	4,1	5,2
VI	3,4	3,9	4,7	7,7
VII	2,1	5,0	5,2	8,3
VIII	1,4	2,3	2,7	4,4
IX	4,6	6,3	5,7	8,1
X	2,2	4,6	4,5	7,4

If there doesn't exist a mental progress in our subjects as far as we consider only the chronological age, one might not be astonished if the interrelationship between the mental tests remains approximately constant. In Table 7 we have presented some few product-moment correlations between the 10 subtests, the combinations of the pairs being chosen at random but in such a way that every one of the tests appears at least once.<sup>2</sup>

It will be noted that there does not exist any tendency for the coefficients to increase or to decrease with age. The mean variations are relatively small for all those pairs of tests in which the coefficients are higher than four times their probable error. For the reasons indicated above we have not thought it necessary to compute more of the possible coefficients. The chance to dis-

<sup>2</sup>Be it noted that none of the coefficients of correlation computed by the present writer has been corrected for attenuation.

cover a definite trend in the amount of the values seems greater when we consider the grades, where a clear cut progress of the performances has been proved.

TABLE 7  
COEFFICIENTS OF INTER-TEST CORRELATIONS OF THE FIVE AGE-GROUPS

Subtests	12	13	14	Ages 15	16	Mean	m.v.
I/II	.486	.411	.450	.567	.525	.488	.051
II/IV	.399	.445	.452	.598	.532	.485	.064
III/V	.279	.291	.520	.455	.341	.377	.088
III/VIII	.086+	.325	.283	.139+	.211+	.189	.081
VI/VII	.183+	.209+	.397	.344	.324	.291	.076
IX/X	.519	.269	.398	.294	.177+	.331	.101
Mean	.326	.325	.416	.400	.352	.360	.035

(Asterisk+, where the values are lower than 4 times their probable error.)

TABLE 8  
COEFFICIENTS OF INTER-TEST CORRELATION ( $r$ ) IN THE FOUR GRADES

Subtests	Grades				Mean( $M_{gen}$ )	m.v.
	IVp	Vp	Im	IIm		
I/II	.435	.416	.526	.543	.480	.054
II/IV	.560	.403	.462	.481	.476	.044
II/VII	.530	.466	.418	.435	.461	.036
IV/VII	.405	.352	.450	.525	.432	.054
III/VI	.412	.294	.413	.454	.395	.049
IV/IX	.334	.344	.329	.406	.353	.026
III/V	.288	.334	.350	.294	.317	.025
VI/VII	.168+	.346	.346	.349	.302	.067
III/X	.242	.284	.300	.288	.279	.018
I/V	.193+	.304	.259	.296	.263	.037
III/VIII	.084+	.316	.278	.329	.252	.084
I/IX	.265	.139+	.260	.341	.251	.056
V/VI	.202+	.140+	.152+	.268	.191	.044
VIII/X	.020+	.148+	.192+	.183+	.136	.061
VIII/IX	.141+	.080+	.155+	.150+	.132	.026
Means	.285	.291	.326	.356	.314	.026
SD	.156	.112	.110	.105	.115	

(The values with an asterisk + are lower than four times their probable error.)

Amongst the 45 possible coefficients for every grade we have calculated 15 chosen at random, except that all the 10 subtests had to be considered more than once, generally three times.

In Table 8 the values of  $r$  have been given with their means and mean variations for 15 combinations of the subtests and for each grade. Looking at the last but one horizontal row, we might recognize a slight and continuous increase of  $r$  with the higher grades. But this result appears rather uncertain if we consider the amount of the mean variations and  $SD$  values.

And besides, an examination of all the single rows reveals that the apparent increase exists only in one test combination without interruption (VI/VII) whilst all the other combinations show irregularities or even inversions (II/VII). Moreover, the lower coefficients in Grades IV<sub>p</sub> and V<sub>p</sub> depend greatly upon the insignificant values (with asterisks). Therefore we should not have much confidence in the reliability of the apparent average increase, which after all is very small in comparison with the *SD* values. The critical ratio for the largest difference, that between the Means in IV<sub>p</sub> and II<sub>m</sub>, is only .138. It seems therefore more probable to assume that the value of *r* remains invariable and independent of school progress in the grades which we have taken into account. It is to be noted that the range of the coefficients is large: from .020 to .560, and that their magnitudes are closely associated with the particular combinations of the subtests. This means to say that the constancy of *r* seems not to be dependent upon its amount.

The truth of this affirmation can be checked to a certain degree by a comparison of the ranks of the values of *r* in the different grades and in their means. For this purpose we calculate the Spearman coefficients of rank coördination (Rho). As will be seen from Table 9, these coefficients are fairly high.

TABLE 9  
COEFFICIENTS OF RANK COÖRDINATION (RHO) OF THE 15 VALUES OF *r* WITH REFERENCE TO THE DIFFERENT GRADES AND TO THE MEAN (*M<sub>gen</sub>*)

Grades	Rho	PE
IV <sub>p</sub> /V <sub>p</sub>	.605	.116
IV <sub>p</sub> /I <sub>m</sub>	.784	.071
IV <sub>p</sub> /II <sub>m</sub>	.763	.077
V <sub>p</sub> /I <sub>m</sub>	.861	.047
V <sub>p</sub> /II <sub>m</sub>	.755	.078
I <sub>m</sub> /II <sub>m</sub>	.865	.046
IV/ <i>M<sub>gen</sub></i>	.770	.075
V <sub>p</sub> / <i>M<sub>gen</sub></i>	.774	.073
I <sub>m</sub> / <i>M<sub>gen</sub></i>	.968	.011
II <sub>m</sub> / <i>M<sub>gen</sub></i>	.892	.037

If there does not exist a noticeable change in the correlation of the different subtests considered in spite of the increase of chronological age and school grade, and if, therefore, no visible influence of mental development upon the relationship between the required performances can be recognized, one may propose the question whether the youngest children have already such maturity as to prevent a further differentiation or integration, or if their development will

essentially follow later than at the age of 16 years and at Grade II<sub>m</sub>. But both assumptions are not probable. For mental development, as characterized by the increase of the scores in the four Grades, is very marked, as will be seen from Tables 1 and 4. And besides, the Terman test would be too difficult for the lower grades and ages, and not well appropriate to the ages higher than 16 years according to Terman's own indications, which agree with our own experiences. Further investigations with the same test with pupils of lower and higher grades will therefore be of little help with respect to our problem.

We may, however, avail ourselves of some few results obtained with older subjects who have been examined with problems comparable with some of the Terman tests, though certainly more difficult. In every one of the years 1936 till 1938 approximately 600 subjects with an average age of 19 to 20 years were examined by the present writer in order to be admitted to the University (1). Amongst the tests, which changed from year to year, there were some similar to subtests Nos. II, III, VII, and X of the Terman series. In Table 8 we represent the only available values of  $r$  which can be compared with the coefficients of Table 16.

TABLE 10  
COMPARISON OF THE  $r$  VALUES IN TERMAN'S GROUP TEST WITH SOME OF THE UNIVERSITY SERIES

Grades	Terman's group test (Table 6)					University test series				
	IV <sub>p</sub>	V <sub>p</sub>	Im	II <sub>m</sub>	Mean	Years	1936	1937	1938	Mean
Test II/VII	.530	.466	.418	.435	.464		.472	.294	—	.383
Tests III/X	.242	.284	.300	.288	.279		—	—	.267	.267

If we were allowed to consider the different tests presented in a horizontal row as much of the same nature, we might affirm once more that neither the increased age nor the somewhat different social composition of the University aspirants has a definite influence upon the magnitude of  $r$ .

In the literature we have not found any material which would be enlightening with respect to our problem of the changes of the correlation between mental tests, with the only exception of some investigations by Wechsler who, for purposes different from ours, presents all the correlations obtained with his Bellevue Scale on 355 subjects between 20 and 34 years of age, and separately those obtained on 235 subjects between 35 and 49 years (8). We have made a synthesis of his  $r$  values in Table 11, where the numbers of the tests correspond to the subject matters indicated as follows:

Test No. 1: Information;	Test No. 6: Block design;
No. 2: Digit memory span;	No. 7: Object assembly;
No. 3: Arithmetical reasoning;	No. 8: Digit symbols;
No. 4: Picture arrangement;	No. 9: Similarities;
No. 5: Picture completion;	No. 10: General comprehension;

In Table 11 we have joined the values of  $r$  of both age groups in such a way that those of the younger subjects are represented above those of the older ones.

Now if we study the values of  $r$  in both groups, the first impression is that many of the differences are small and that generally the values of the older

TABLE 11  
COEFFICIENTS OF CORRELATION ( $r$ ) OF WECHSLER'S SCALE FOR SUBJECTS OF 20-34 (ABOVE)  
AND 35-49 (BELOW) YEARS OF AGE

Tests	1	2	3	4	5	6	7	8
2	.484							
	.438							
3	.596	.443						
	.594	.470						
4	.384	.264	.366					
	.477	.341	.459					
5	.465	.297	.403	.389				
	.492	.288	.420	.482				
6	.488	.399	.514	.484	.566			
	.597	.416	.519	.365	.534			
7	.224	.155	.233	.272	.439	.536		
	.416	.274	.352	.359	.467	.506		
8	.561	.539	.429	.444	.400	.538	.319	
	.563	.523	.552	.516	.433	.613	.377	
10	.668	.444	.517	.391	.456	.465	.286	.478
	.705	.372	.534	.451	.465	.516	.357	.516

subjects are higher. Amongst the 36 pairs there are only eight exceptions. Further, the mean of all the coefficients differs in the same sense: that of the younger group is smaller (.426) than that of the older ones (.465). But this difference is not significant, the critical ratio having a value of 1.66. The conclusion is that, if there existed a development from one age group to the other, this fact would have no parallelism in the change of the correlations. But, of course, such a development is rather improbable since all the subjects are already adults.

### C. MOTOR TESTS

The Terman Group test refers only to verbal intelligence, the Wechsler Scale to verbal as well as to non-verbal intelligence. If no significant change of the correlations can be found with respect to intelligence during development, it has to be seen if the same is true with respect to motor abilities.

In this case, we have not at our disposal material as numerous as could be desired. It seems, however, interesting to see if an essential difference is to be expected, hoping that further investigations will check our results.

For our study we make use of the facts presented by Sardon (6) who has employed a series of individual motor tests on Peruvian pupils of both sexes in the II to the VI grades of different Lima primary schools, whose ages varied between 9 and 15 years. Thirty children of each sex and of each of four age-groups (9, 11, 13, 15 years) were examined with a battery of five tests: (a) Tapping with the skillful hand during 20 seconds ( $Ts$ ); (b) Tapping with the unskillful hand during 20 seconds ( $Tu$ ); (c) Steadiness of the fixed skillful hand during 30 seconds ( $Sf$ ). For the determination of this ability a tremometer constructed by the present writer many years ago was used. The skillful hand had to hold steadily a ring with an inner diameter of 7 mm. without touching a metal rod, 3.3 mm. thick, over which the ring had been lead at the beginning of the experiment. The number of contacts produced by the trembling of the ring and causing the noise of a buzzer was taken as a measure of the errors. Since this number is inversely correlated with the development and with the scores of the former tests, we have converted these values in mean intervals of time between two successive errors. In that way the originally negative coefficients of correlation were transformed in positive ones.<sup>3</sup> (d) Steadiness of movement ( $Mo$ ). Using the same apparatus the subject had to lead a similar ring with an inner diameter of 9.8 mm. slowly over a smoothly curved rod in form of a sickle till its end, and then return without touching it. The diameter of the rod was 3.3 mm. Once more the number of contacts was the original measure of steadiness. The score was analogously converted in the mean length of the rod passed without making a contact. (e) Construction ( $Co$ ). Two iron wires had to be bent without any tool according to two different drawings which the pupils were not allowed to touch, but which remained visible for the subject during the work period. The scores were the marks given by two independent judges who organized the totality of all the products of the 240 subjects, distributing them according to their quality without regard for the subject and his age. The marks for every one of the two models varied between 0 and 8 allowing a maximum score of 16.

The details of the tests and their results have been presented in the article cited above.

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<sup>3</sup>It should be noted that the absolute values of the coefficients of correlation are not wholly indifferent towards such a transformation. No attempt was made to investigate the influence of this factor.

In Table 12 the correlations between the items computed by the Pearson product-moment method are to be seen. It will be noted that the range of the coefficients is great, their maximum being .775, and the minimum .000, without taking into account the sign. The variability of the values is likewise rather large owing in part to the relatively small number of subjects.

TABLE 12  
COEFFICIENTS OF CORRELATION ( $r$ ) FOR THE FOUR AGE-GROUPS OF BOTH SEXES

Tests	Boys					Girls				
	Years of age					Years of age				
	9	11	13	15	Mean	9	11	13	15	Mean
(1) Ts/Tu	.573	.486	.392	.652	.527	.775	.608	.750	.660	.698
(2) Ts/Co	.422	.234	.458	.264	.345	.083	.000	.257	.207	.137
(3) Ts/Sf	.154	.450	.137	.502	.286	-.089	-.027	.196	.479	.140
(4) Ts/Mo	.270	.295	.205	.427	.299	-.044	-.004	-.356	-.120	-.107
(5) Sf/Tu	.333	.124	.142	.328	.232	-.231	.040	.360	.305	.119
(6) Sf/Co	.139	.053	.269	.214	.168	.319	.044	.127	.127	.155
(7) Sf/Mo	.565	.363	.489	.640	.513	.523	.108	.435	.057	.281
(8) Co/Tu	.322	.131	.131	.004	.147	.017	.350	.152	.173	.173
(9) Co/Mo	.336	.170	.319	.014	.210	.460	.129	.122	.147	.214
(10) Mo/Tu	.040	.050	.290	.475	.214	.076	-.230	.010	-.135	-.071

(Only the values greater than .415 are more than four times as large as their *PE.*)

Notwithstanding the great variability of values and although it would not be justifiable to speak of a constancy of the coefficients of each sex during its development, at least it seems rather safe to say that there is no definite trend to be seen, either in the sense of an increase or in that of a diminution. The irregularity of the fluctuations is the only conclusion which we may deduce from the table.

The mean values of the corresponding coefficients in both sexes are rather different. Nevertheless, some consistency cannot be denied. If we compare their magnitudes, taking into account the sign, the Spearman coefficient of rank coordination

$$\text{Rho} = .581 \pm .148.$$

It might be supposed that, as well as the mental progress of the Peruvian child, motor development depends more upon grade than upon chronological age. This point of view had not been considered in the original investigation, particularly because the development was clearly apparent with respect to age. As a matter of fact, the number of subjects is rather small in some of the grades. Yet it seemed worth while to use the existent material with a view to school promotion, eliminating the grades with too few pupils. From Table 13 the numbers of subjects considered and the scores may be seen.

The trend of values is, in this case, not essentially different from that which Sardón has found with respect to chronological age.

TABLE 13

Grades No. subjects Tests	Boys				Girls			
	II 16	III 22	IV 53	VI 11	II 29	III 25	IV 33	VI 16
Ts	106,5	123,5	124,9	132,9	111,8	119,1	120,8	125,0
Tu	95,5	104,4	108,7	117,0	93,8	100,9	107,0	110,5
Sf	0,93	1,60	1,75	2,36	1,36	1,45	1,57	2,18
Mo	1,13	1,79	2,02	2,08	1,31	2,16	2,16	2,26
Co	6,1	6,8	8,6	10,2	4,8	7,0	8,4	9,1

TABLE 14  
COEFFICIENTS OF CORRELATION ( $r$ ) OF THE MOTOR TESTS IN THE SCHOOL GRADES

Tests	Boys					Girls				
	II	III	IV	VI	Mean	II	III	IV	VI	Mean
Ts/Tu	.695	.640	.480	.872	.672	.474	.810	.761	.864	.729
Ts/Co	.000	.332	.592	.005	.212	-.436	.212	.475	.538	.197
Ts/Sf	.585	.475	.375	.480	.479	-.026	.400	.297	.125	.199
Ts/Mb	.508	.750	.248	.595	.549	-.092	.185	.244	.573	.228
Sf/Tu	.520	.431	.234	.352	.380	.027	-.147	.477	.061	.104
Sf/Co	.268	-.132	.368	.115	.155	.134	.321	.263	.292	.253
Sf/Mo	.641	.578	.368	.910	.624	.561	.104	-.122	.426	.242
Co/Tu	.114	.314	.298	-.138	.147	-.167	.292	.254	.473	.213
Co/Mo	.282	.407	.194	-.074	.202	.442	.465	.010	.324	.310
Mo/Tu	.590	.492	.186	.595	.466	-.224	.236	.100	.469	.145

The progress is clear in all the tests and in both sexes. Now if we calculate the correlations, the result is likewise much similar to the former one, as may be seen from Table 14.

The range of values is still larger than in Table 12, varying from .910 to .000 without taking into account the signs. And in each pair of tests there appear great and irregular fluctuations without any rule and without any noticeable relation to the values in the other pairs of tests. The coefficients for both sexes are perhaps even more different than in Table 12. Many of the coefficients are not significant, partly because of the small number of subjects, especially in Grade VI of boys and girls, and in Grade II of the boys. For these reasons, we should not attribute much certainty to these results, if they were not in apparent accord with those formerly found. Indeed, if we calculate the Spearman coefficient of rank coördination, in the same way as we have done with respect to Table 12, the ranks of the mean values in both sexes show the same correspondence as there:

$$\text{Rho} = .581 \pm .148.$$

This might anyhow suggest that the result as a whole has at least certain consistency.

## CONCLUSIONS FROM THE DATA

1. Most of the 19 coefficients of correlation between certain physical traits found by Baldwin do not change significantly during the development of each sex from (7-9) to (10-12) years. The means of the 19 coefficients are practically identical. The same is true with respect of the correlation between weight and height found by Brooks in girls ranging from 10 to 15 years of age.

2. The means of the same coefficients are lower for the girls than for the boys, but the difference is not significant.

3. Six inter-test correlations of the Terman Group Test of mental ability do not show any distinct trend during the progress of chronological age from 12 to 16 years, which, to be true, involves no intellectual progress either.

4. Fifteen inter-test correlations of the same test arranged according to promotion from Grade IVp to IIm gave the same result, although in this case there exists a clear progress in the scores. Some of the comparable values for University aspirants are of the same magnitude.

5. Most of the intercorrelations of Wechsler's Bellevue Scale are very similar for subjects of (20-34) and (35-49) years of age. The difference between the means is insignificant.

6. In five motor ability tests, the scores of which show a clear progress from 9 to 15 years and from Grade II to Grade VI, in both sexes there does not appear a distinct trend in the interrelationship of the tests, neither with respect to chronological nor school progress.

From all this it seems that during the considered stages of development the coefficients of correlation between the numerical figures and test scores which we have considered do not increase or diminish in a definite way. The irregular fluctuations might be interpreted as a sign of an intrinsic constance, if larger groups should be examined.

## DISCUSSION

The rather uniform results we have obtained are related to correlation coefficients and their constancy during human development. We must try to interpret this finding. A correlation coefficient is an index of a correspondence between two series of measures, the value of which can vary between  $+1$  and  $-1$ . It indicates "how far the changes in any variable magnitude are accompanied by corresponding changes in another." Therefore, in the case of psychological tests the coefficient "determines the degree of dependence between one ability and the other" (7, p. 56).

We have not been interested in the magnitudes of these coefficients, legions of which are to be found in the literature, but in their changes during development. If we accept Spearman's formulation, we should say then that the different abilities considered here guard their degree of mutual dependence, high or low as it may be, or that they fluctuate round some central value which may have whatever magnitude. The coefficients do not reflect, as it seems, biological or psychological progress, which is the very essence of development during childhood and adolescence. Although the height and the weight of the children's bodies grow, although their mental and motor performances increase, the interrelation between them does not change substantially in one sense or the other.

Biologists and psychologists are accustomed to contemplate evolution as a process of organization characterized by quantitative and qualitative variations of a growing organism conditioned by an increasing *differentiation* and an increasing *integration*. If unities of a relatively simple and diffuse character become more distinct, variegated and articulated, we speak of differentiation. And different and originally autonomous unities become connected and subordinated one to the other, we call the process "integration." Both processes, though to a certain degree opposite in their effects, do not neutralize each other. Joined, they produce a greater variety of structure and of behavior and a more exact and more complicate interplay of the different factors which coöperate.

If we try to apply these ideas to our results, we meet with unexpected difficulties in the anthropometric field. The constancy of the correlation between height and weight, for example, may depend upon a more or less proportional increase of the forces and factors responsible for their growth, whatever and however composed these may be. But if we suppose that besides their increments the inner organization of those forces and factors becomes more differentiated and or integrated, it seems less comprehensible that such a change leaves the amount of the correlation coefficient without alteration.

It is still more venturesome to advance any hypothesis with respect to the psychological factors which might be responsible for the apparent invariance of  $r$  during the contemplated development. But the same argument holds also in this case. The assumption of striking changes in the organization of the factors coöperating in the solution of intellectual problems and in motor performances makes the understanding of the constancy of the correlation coefficients harder. If we were allowed to believe in essentially quantitative changes of the factors which participate in a more or less complicated manner in the achievements, the theoretical task would be easier.

As far as test performances are concerned, *the coefficients of correlation which we have found seem to depend rather exclusively upon the nature of the tests, and not upon the age of the subjects and their level of maturation.* Of course, the hypothesis advanced needs to be checked with a greater material and with other tests. If it were corroborated, the *principle of the constancy of the correlation* would undoubtedly have importance for the theory of human development, even though it were valid only for a certain range of age.

Indeed, it is highly questionable that our results admit a large generalization, as well with respect to the abilities as with respect to the ages of the children. They might be of limited value. Particularly in infancy our hypothesis is probably wrong. Bayley found that during the first 15 months of life, there was "a relatively high degree of relationship ( $r = .50$ ) between motor and mental abilities, as far as these could be differentiated and separately measured. Success in one sphere seemed to be associated with success in the other. After the age of 15 months, however, the correlations were still positive, but low. Shirley found a correlation of .28 between precocity in walking and intelligence (as measured at 18 months)" (5, pp. 103/104).

Furthermore, the mental structure of individuals has without doubt to be taken into account. An investigation carried out by Abelson shows that in 12 mental, perceptual, and motor tests practically all the coefficients of correlation are much higher for 22 defective children than for 78 normal ones. The difference of the means (.782 and .466 respectively) has a critical ratio of 9.2 (7, p. 218). Though this difference might be smaller if the values had not been corrected for attenuation, it seems established that the abilities involved are much more higher integrated in mentally defective children than in others.

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## A STUDY OF FEEDING MECHANISMS IN PREMATURE INFANTS\*

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An earlier investigation (2) revealed that feeding at breast or bottle was accomplished with comparative ease by some infants and with varying degrees of difficulty by others. Ease of feeding was associated with well-coordinated sucking, swallowing, and breathing, and difficulty in feeding with lack of coordination. The three activities were found to be well-coordinated when the sucks and swallows recurred in rhythmic units and breathing was so adjusted to the suck-swallow rhythm that the three activities proceeded with no apparent interruption. The conditions attending this adjustment were as follows: the sucking, swallowing, and breathing movements recurred regularly, the sucking movements took place simultaneously with the breathing movements, and finally, the temporal relationship between these activities was such that swallowing occurred as a continuation of the sucking movement at a natural pause in breathing.

These findings were in accord with those obtained by Peiper (5, 6). However, Peiper would have us believe that the regular recurrence of the food-taking and breathing movements was an indication that the remaining conditions essential to good coordination were necessarily present. Our investigation showed that regularity of functioning was in itself not sufficient evidence of good coordination. Of the various methods employed by infants in carrying on the food-taking and breathing activities, two which were frequently used showed the activities recurring in regular sequence over protracted periods despite repeated interference. In one, sucking and swallowing took place regularly during a prolonged pause at mid-inspiration; in the other, they occurred during an equally long pause after inspiration (2, p. 193). The interruption of breathing during inspiration by the food-taking activities represented interference with breathing by both sucking and swallowing. Sucking and swallowing at the pause after inspiration also indicated a lack of coordination, since swallowing alone should take place at this point. Sucking at this phase of the respiratory cycle prolonged the pause, and the prolongation represented an interruption of the breathing activity.

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Although various types of coördination were exhibited, the activities were most smoothly combined when sucking occurred concurrently with inspiration, ended at the pause after inspiration, and was immediately followed by swallowing. In attempting to account for this fact it was stated that the temporal order of the three activities provided optimal conditions for nursing. In support of this statement it was pointed out that the chest functioned not only in breathing but also in reinforcement of the sucking movements, and that these suck-reinforcement movements, expansion and stiffening, coincided with those of inspiration and the pause after inspiration. Furthermore, since swallowing normally took place immediately after sucking and was of very brief duration (2, p. 202), its occurrence at the natural pause after inspiration preserved the close suck-swallow sequence and at the same time caused no appreciable interference with the breathing activity.

An interesting fact revealed by the earlier study was that ease of feeding was not essentially a function of age. Of eight breast-fed infants who were less than four days old at the start of the investigation, four exhibited well-coördinated sucking, swallowing, and breathing during the first experimental period. Three of these infants continued to show good coördination throughout the 18 weeks of the investigation, even during the transition from breast to bottle. The fourth infant experienced difficulty during the transition. The four remaining infants failed to exhibit coördination during the first experimental period and, although they met with varying degrees of success at subsequent periods, there was no consistent improvement with age. These findings would appear to indicate that conditions other than age are essential to coördination.

In the present paper, interest centers on the ease with which four of the subjects adjusted to the feeding situation. The presence of well-coördinated sucking, swallowing and breathing so soon after birth suggests that coördination may be achieved at a still earlier date, even though the evidence does not appear to support this view.

Although it is generally admitted that breathing, swallowing, and sucking movements occur in the fetus, the neuromuscular mechanism for breathing, as well as that for the suck-swallow reflex, is believed to be imperfectly developed before birth (1). The literature indicates that in infants born prematurely the breathing mechanism functions sluggishly. Respiration is not only weak and irregular, but Cheyne-Stokes breathing is common. Sucking and swallowing movements are weak and irregular (1, 4). Hertz (3) produces evidence which shows that the negative suction pressure of prematures is less than that of the weakest full-term infants. The only study

bearing on the relationship between sucking and breathing during nursing is that of Eckstein, cited by Peiper (6), who states that in premature infants respiration becomes shallow during strong sucking.

### APPARATUS

The apparatus was essentially the same as that employed in the earlier experiment. Sucking movements of the chin and breathing movements of both chest and abdomen were recorded simultaneously on kymograph paper. Swallowing (transit of milk through the pharynx) was stethoscopically observed and related to the sucking and breathing curves as they were recorded. Depressing the chin produced an up-stroke on the sucking curve, and elevating the chin, a down-stroke. Similarly, expansion of chest and abdomen was represented by an up-stroke on the breathing curves and contraction of chest and abdomen by a down-stroke.

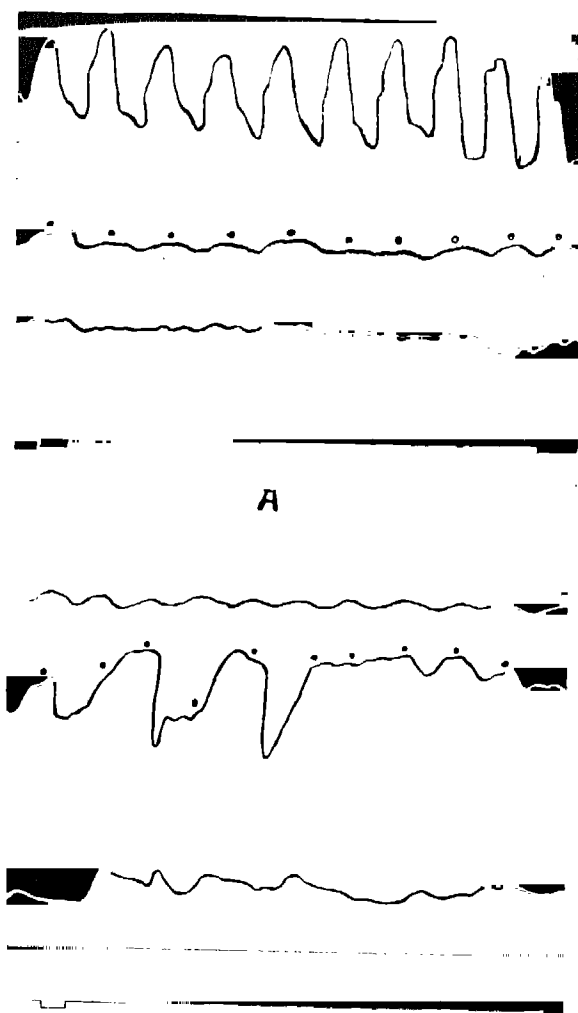
No attempt was made to ascertain sucking power. Sucking was designated as strong or weak from its effect on breathing (2). In this connection it should be added that the sucking curves were not comparable for determining the amplitude of the movements of the chin for the individual subjects. For example, the difference in amplitude between the curves of the two subjects under investigation was due in large part to the difference in length of neck. However, depression and elevation of the chin were clearly shown. The small amplitude of the breathing curves for the first few weeks was due in part to the low gaseous exchange at this stage of life and in part to the presence of the broad abdominal band which covered a considerable portion of both chest and abdomen.

### METHOD OF STUDYING THE KYMOGRAPHIC RECORDS

The method employed in studying the records was the same as that used in the earlier study. In short, the individual sucks and swallows were plotted on a straight-edge which was then applied in turn to the costal and abdominal curves to determine at what phase of the respiratory cycle the sucks and swallows occurred. The straight-edge was similarly used to determine the type of breathing. Data were also obtained pertaining to breathing and sucking rates.

### SUBJECTS

The subjects were *P*, a girl born  $4\frac{1}{2}$  weeks prematurely; and *W*, a boy, born 6 weeks prematurely. Their birth weights were 4 lb. 9 oz., and 4 lb. 14 oz. respectively. The general physical condition of the subjects was



**B**  
FIGURE 1

SUCKING AND BREATHING CURVES OF THE TWO SUBJECTS

A. Subject *P* at 9 hours after birth.  
 B. Subject *W* at 7 weeks. From top to bottom the lines represent, respectively, the movements of the lower jaw, chest, and abdomen, and the time in 10-second intervals. Depression of the lower jaw is indicated by an upstroke on the sucking curve, expansion of chest and abdomen by upstrokes on the breathing curves. The small dots above the costal curves show when swallowing occurs.

pronounced satisfactory and little difficulty was experienced in conducting the experiment. Both subjects were first-born.

The two subjects were fed by bottle with the same nipple which was sterilized after each feeding. The nipple was soft and much smaller than the conventional type. Very little pressure was required to obtain the food. In fact, when the bottle was inverted the milk oozed slowly through the nipple at a rate of approximately eight drops per minute.

The experiment covered the first nine weeks of life. Feeding records were obtained of *P* at her first nursing experience, nine hours after birth. Other records were obtained at one week and at bi-weekly intervals thereafter. *W* was not available until the eighth day. Records of his feeding performances were taken at one week and at bi-weekly intervals thereafter.

#### PROCEDURE

The subject was undressed in the nursery ward, wrapped in a previously warmed blanket, and carried a short distance to the experimental room, the temperature of which was about 85°F. The subject was then placed supinely in the experimental crib, the blanket was spread out beneath him, and a dry diaper placed under the buttocks and legs. The apparatus was carefully attached to the subject and tested. A light blanket was then spread over the subject and the apparatus again tested. The experimenter now started the kymograph, gave a signal to the assistant, who inserted the nipple into the mouth of the subject, and took a 60-second record of sucking and breathing. Additional records of the same duration followed at 30-second intervals until six samples were obtained. While the records were being taken, the experimenter and assistant in turn made stethoscopic observations of swallowing. The nipple was removed from the mouth for a brief period after each record.

#### RESULTS: MANNER IN WHICH THE FOOD-TAKING AND BREATHING ACTIVITIES FUNCTIONED DURING FEEDING

##### 1. *Subject P*

The subject's eyes were closed most of the time at her first feeding experience and she became very sleepy at the end of the experimental period. Her activity increased during the first minute, was highest in the third minute, and decreased rapidly after the fifth minute despite persistent efforts to prevent her going to sleep by raising and lowering the nipple and rotating it between her lips.

Sucking did not start at once when the bottle was presented. Although

the lips immediately went into action, the movements resembled licking and mouthing rather than sucking, and the mouth was closed only loosely on the nipple. Small sporadic chin movements were also observed. After several seconds a perceptible tightening of the lips was followed by a relatively slow and pronounced depression of the chin (believed to be the first actual sucking movement) and momentary cessation of breathing. The chin was rapidly elevated and a short pause ensued during which the subject lay breathing quietly. The pause was quickly succeeded by more mouthing movements. Periods of quiescence followed intervals of mouthing and sucking during the remainder of the first 60-second feeding trial.

Breathing was generally rapid and irregular. The rate was higher during quiescent periods than during intervals of sucking. Sucking and swallowing were sporadic and irregular. The sucks sometimes occurred singly and at other times in series of two to five in number. In a series of sucks the suck-respiratory ratio was approximately 1:1 with breathing somewhat faster than sucking.

Sucking and swallowing interfered with breathing. Momentary pauses at varying phases of the breathing curves indicated when the subject sucked and swallowed. Other pauses in the absence of sucking probably indicated when swallowing alone occurred, since the milk oozed slowly through the nipple under its own pressure. That swallowing actually took place at these pauses could not be definitely determined, because the act frequently escaped detection when sucking and breathing were irregular (2). However, these pauses were not present in the breathing curves which preceded and followed the feeding record.

Breathing also interfered with sucking. On several occasions the chin was brought to a sudden stop midway in its sucking movement by an abrupt respiratory movement.

Of special interest was the fact that the subject frequently displayed an inclination to suck and swallow during the pause after inspiration. This inclination was disclosed not only in instances of isolated sucks but on three separate occasions of successive sucks embracing two, three, and four respirations respectively. Thus, despite the generally sporadic sucking, coördination was anticipated during three brief intervals in this first minute of feeding. This finding was significant in view of the improvement during the third feeding interval and in view of the fact that good coördination was actually achieved before the end of the feeding period.

Sporadic sucking gave way to serial sucking during the second minute of feeding. The third minute found *P* sucking steadily. She usually sucked

once per respiration and only rarely changed to two sucks per respiration. The salient features of the feeding performance were the slow and steady movements of chin and chest and the relatively long pauses between sucks. Analysis of the kymographic records showed that the usual order of the breathing, sucking, and swallowing movements was as follows:

Inspiration (elevation of chest and abdomen) and elevation of chin after swallowing.

Immediate depression of chin in sucking during the pause after inspiration.

Swallowing with chin fully depressed during continuation of the breathing pause.

Expiration (contraction of chest and abdomen).

Inspiration and elevation of chin after swallowing.

This order persisted until the fifth minute, when a change in the temporal relationship between the food-taking and breathing activities resulted in well-coördinated sucking, swallowing, and breathing. Sucking now occurred simultaneously with inspiration, and swallowing took place at the pause after inspiration. This manner of carrying on the activities predominated at all later feeding periods (Figure 1).

## 2. Subject *W*

As we have already indicated, Subject *W* was not available for experimentation until the eighth day. According to our classification (2) *W* was definitely a poor feeder, since his records failed to reveal any evidence that the three activities were well-coördinated. The nearest approach to good coördination was exhibited at 7 weeks during exceptionally strong sucking when, as a result of an extraordinary adjustment of the breathing activity, sucking was regular for a short period (see Figure 1). The high elevation and rigidity of the chest and the forced breathing attested to the great effort involved in making the adjustment (2).

Since the nipple yielded milk readily, the general lack of coördination evidenced by the subject was not due to difficulty in obtaining the food. Actually, feeding for the most part was accomplished by relatively weak sucking. Rather, his poor feeding performances appeared to be due to the persistence of rapid, shallow breathing. Indeed, comparison of the breathing curves showed that respiration was approximately as rapid, shallow, and irregular during feeding as during the rest periods.

Our earlier study revealed that coördination was usually achieved when breathing was relatively slow, and was rarely exhibited when the breathing

rate exceeded 72 respirations per minute. Despite the two occasions in which relatively slow breathing was recorded (Table 1), Subject *W*'s breathing was usually faster than 75 respirations per minute and apparently could not be adjusted to the equally rapid sucking which frequently exceeded 85 sucks per minute. Thus, while both activities were carried on at high speed, they functioned at different rates, with the results that swallowing interfered with breathing and breathing interrupted the suck-swallow sequence.

The following description of a short portion of a record obtained during the third minute of feeding in the third week is typical of *W*'s failure to coordinate the three activities.

Breathing is generally rapid and irregular. The sucking movements are also rapid but more regular. The chin is depressed with a quick movement and immediately elevated. Elevation, however, is relatively slow. The sucking and breathing movements occur concurrently, but the two activities function independently of each other, since at no time do two successive sucks occur at corresponding points in the respiratory cycles. Because of the high breathing rate, the respiratory movements usually follow each other in rapid succession with no perceptible pause between the movements. The frequent brief pauses appearing in the curves indicate the places at which the subject momentarily suspends breathing to swallow. Since swallowing normally takes place immediately after sucking, and sucking is irregular with reference to breathing, the pauses occur at varying phases of the respiratory cycles. Thus each act of swallowing represents an interruption of the breathing activity.

On the other hand, breathing frequently interferes with the suck-swallow sequence. The interference is usually evidenced when sucking occurs at the end of a respiratory movement. For example, when sucking takes place near the end of inspiration, swallowing may not occur until mid-expiration or until expiration is completed. Similarly, when sucking occurs at the end of expiration, swallowing is often suspended until the next inspiratory movement is well underway or completed. One gains the impression that the delay in swallowing on these occasions is due to the momentum of the breathing movements.

Variations in the magnitude of the movements of the chin give the impression that the sucking movements in many instances are not completed. Swallowing movements do not always follow the sucking movements. They sometimes occur when the subject is resting.

Despite the interference and difference in rate between the food-taking and breathing activities, respiration is no more irregular than that which prematures exhibit during waking periods.

## DISCUSSION

From our analysis of the records it is evident that the two subjects using the same nipple employed different methods in carrying on the food-taking

and breathing activities. The fact that for one subject the sucking, swallowing, and breathing movements recurred without apparent interruption at the first feeding indicates that good coördination may be achieved before the end of the normal gestation period. On the other hand, we are again (2) confronted by the problem of why, under apparently similar conditions, good coördination was exhibited by one subject but not by another.

It might be contended that *W*'s failure to show coördination was due to his weak sucking. Peiper (5, 6), we have noted, asserted that coördination occurred as a result of the adjustment of the breathing reflex to strong sucking movements. Strong sucking movements, he stated, retarded breathing and forced their rhythm on the breathing movements, whereas weak sucking had little effect on breathing.

The results obtained with *W* appear at first sight to support this view. It will be recalled that *W*'s feeding performances showed a trend toward good coördination on only one occasion—during a short period of very strong sucking. This trend was also manifested in our earlier study (2) by subjects who, like *W*, otherwise consistently failed in coördination during both weak and moderately strong sucking. However, the evidence as a whole appears to indicate that sucking power in itself has little or no connection with coördination.

In the introduction we stated that in good coördination the food-taking and breathing movements occurred without perceptible interference with each other. We pointed out that the conditions under which interference was avoided were: (a) the movements recurred in regular sequence; (b) swallowing took place at a natural pause in breathing, viz., the pause after either inspiration or expiration; and (c) the sucking movements were carried on simultaneously with the breathing movements.

With these conditions as our criteria, the earlier data (2) revealed that on all occasions in which good coördination was shown, the sucking movements were either weak or only moderately strong.<sup>1</sup>

Good coördination was never exhibited during strong sucking because the third condition could not be fulfilled. Strong sucks always brought breathing to a pause. However, the two remaining conditions were observed on all occasions in which both sucking and swallowing occurred regularly at the pause after either inspiration or expiration. Hence, it might be said that limited coördination was exhibited during strong sucking. It was when the

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<sup>1</sup>Our earlier paper (2, pp. 191-199) disclosed that sucking could be classified as strong, moderately strong, weak, and very weak, in accordance with its effect on the breathing curves. Very weak sucking was generally rapid and accompanied by fast breathing, but the two activities never functioned at the same speed.

activities were so combined that Subject *W* at 7 weeks exhibited what we termed an approach to good coördination. In this connection it was only when this combination was employed that interference with breathing during strong sucking was minimum, viz., confined to sucking. Sucking at any other point than at a natural breathing pause resulted in increased interference by introducing an extra pause into the breathing cycle. For example, some infants attempted to suck regularly during inspiration. Since swallowing generally occurred with sucking, the resulting pause at mid-inspiration represented interference by both activities.

The earlier data also revealed that the feeding performances of the good feeders were generally better, viz., the sucking, swallowing, and breathing activities were more smoothly combined, during weak sucking than during moderately strong sucking because the breathing and sucking movements became larger and more abrupt as the sucking power increased. *P*'s performances in the present paper evidenced this trend.

Associated with these findings were the leisurely manner in which the good feeders carried on the feeding activity and the display of haste by the poor feeders. Indeed, one of the significant findings was that conditions for achieving good coördination were more favorable when the sucking and breathing rates were relatively low, viz., less than 72 sucks and 72 respirations per minute, than when they were high. According to the data, good coördination was exhibited in 70 per cent of the instances in which both sucking and breathing rates were low, in 27 per cent of the instances in which the sucking rate was high and the breathing rate low, and in 22 per cent of the instances in which both rates were high. The data also showed that the mean sucking and breathing rates were significantly (14 sucks and 9 respirations) lower for the good feeders than for the poor feeders. In passing, it should be added that good coördination was achieved with high sucking rates only by good feeders who for the most part employed slow sucking.

Low breathing and sucking rates were associated with sucks of long duration, and high breathing and sucking rates with sucks of short duration. Notable features of the performances of the good feeders were the relatively long duration of their individual sucks and their correspondingly slow breathing during both weak and strong sucking. These subjects characteristically employed slow (long) sucks, viz., .4 sec. or longer in duration, in which the power was increased during the suck instead of being applied suddenly at the start. The chin was slowly depressed for each suck and then as slowly elevated during the period between sucks. The breathing rate

was correspondingly low, so that ample time was provided during each respiration for both sucking and swallowing. Since all three activities proceeded smoothly, it was not surprising that good feeders generally appeared at ease in the feeding situation. Their predilection for employing the slow type of suck, even when the sucking pace quickened, probably explains why these subjects were uniformly successful in maintaining coordination on occasions when they resorted to rapid sucking, why their feeding performances on these occasions failed to reflect the haste evidenced by poor feeders during fast sucking, and why their performances were much smoother than those of poor feeders even when sucking was strong (2).

The poor feeders commonly employed sucks of short duration, viz., .3 sec. or less. The sucks were abrupt, apparently attained maximum power almost instantly, and usually occurred in rapid succession. Since breathing tended to keep pace with sucking, the respiratory movements were also rapid and abrupt. However, they were generally at variance with the sucking movements. Here, then, were two activities proceeding at different speeds. Since the breathing movements were not adjusted to the sucking movements, neither were they adjusted to swallowing. As a result, breathing was interrupted at irregular intervals by swallowing, when sucking was weak, and by both sucking and swallowing, when sucking was strong. The effect of these interruptions and of the hasty resumption of breathing and sucking after swallowing was an acceleration in the speed of these temporarily unrelated activities.

Similar findings were obtained from the present study. In Table 1 the

TABLE 1

RESPIRATORY AND SUCKING RATES, AND DURATION OF THE INDIVIDUAL SUCKS AND THE INTERVALS BETWEEN SUCKS FOR THE TWO PREMATURE SUBJECTS												
Subjects	Birth		1 Week		3 Weeks		5 Weeks		7 Weeks		9 Weeks	
	P	W	P	W	P	W	P	W	P	W	P	W
Resp. rate	61		63	78	61	90	57	88	51	63	78	72
Suck rate	61		63	87	61	94	57	96	51	63	78	78
Mean durat'n of sucks (sec.)	.40		.42	.25	.44	.21	.45	.18	.49	.37	.37	.32
Mean time between sucks (sec.)	.58		.53	.41	.54	.43	.60	.44	.69	.58	.40	.45

data for each age level were derived from a 10-second section of the kymographic record. The section was selected from that portion of the record in which the feeding performance was judged to be best for that day. Ac-

cording to the data, *P*, the good feeder, employed the long type of suck, usually over .4 sec. in duration, and a long interval between sucks; whereas *W*, as a rule, employed the short suck. *W*'s slowest sucking occurred during a short period at 7 weeks at which time he gave his best feeding performance. It will be noted that his sucking and breathing rates were usually at variance.

Significant findings were obtained from subjects (2) who could not be classified as either good or poor feeders, since their feeding performances varied. Examination of their records showed that their best performances were rendered during periods of slow sucking and that their performances were invariably poor when the sucking movements were rapid.

Other findings were equally revealing. Our data showed that whereas poor feeders gave their best feeding performances during periods of strong sucking, their poorest performances also took place during these periods. The best performances were associated with sucks of long duration, and the poorest performances with sucks of short duration. Long strong sucks characteristically occurred during the pauses after either inspiration or expiration and the deep respiratory movements were consummated during the equally long pauses between sucks. Short strong sucks were generally irregular and occurred in too rapid succession to provide sufficient time for the completion of the breathing movements. The interruption of the forced breathing movements by the strong abrupt sucking movements resulted in erratic functioning of both activities.

#### SUMMARY

Kymographic records were obtained of the sucking, swallowing, and breathing movements of two premature infants. Analysis of the records revealed that in one subject the food-taking and breathing activities functioned without apparent interruption at the first feeding period, showing that good coördination between the activities may be achieved before the end of the normal gestation period. An earlier study revealed that good coördination was achieved by appropriate adjustment of the breathing activity to the suck-swallow rhythm. Data from both studies showed that the conditions attending such adjustment were as follows: The breathing and food-taking activities functioned regularly. The breathing movements were relatively slow and smooth, and the pauses between the movements brief. The sucking movements were relatively slow, relatively weak, or only moderately strong, and sucking power smoothly applied.

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# A COMPARATIVE STUDY OF SOME PROBLEMS OF SOCIAL AND EMOTIONAL ADJUSTMENT OF CRIPPLED AND NON-CRIPPLED GIRLS AND BOYS\* 1

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## A. HISTORICAL INTRODUCTION

Information regarding the social and emotional adjustment of crippled children is based, for the most part, on observations of persons who have worked with exceptional children.<sup>2</sup> The consensus seems to be that physical disabilities cause serious social handicaps. To date, there have been few studies of an experimental nature pertaining to this problem.

Contacts with crippled girls and boys have revealed that they, like non-crippled children, have many problems. An attempt to get information from published literature on social and emotional adjustment has disclosed a scarcity of research data. Varied opinions are expressed, but they are seldom based on more than uncontrolled though, perhaps, careful observation.

It has been estimated that there are more than ten million children in the United States who are handicapped by physical defects, including visual and dental disturbances, diseased tonsils, defective hearing, posture, nose and throat troubles. It is reasonable to suppose that many of these defects would be more or less damaging to personality and, consequently, social and emotional adjustment. Most of these children were crippled before the age of seven which has implications for adjustment, particularly, if these defects have been uncorrected. Early discovery and diagnosis is imperative for adequate provision for treatment, and for a training program which will make the most of recognized potentialities.

It is possible that, when these individuals come from homes of low socio-economic status, remedial measures are not undertaken because of inability to finance treatment. Studies on such children would be expected to disclose maladjustments caused by physical defects, as well as by other factors arising from poor economic conditions which would be operative in their home, school, and general social backgrounds. Social and emotional maladjustment could not alone be attributed to physical defects.

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Social and emotional adjustment cannot be studied without obtaining a great deal of pertinent information on all factors which may be involved in its determination. Consideration in this investigation has been limited to some of the problems of adjustment of crippled and non-crippled girls and boys. The approach has been through a study of factors which were thought to be of importance in social and emotional adjustment. Many of these will be pointed out in the review of previous investigations.

### 1. *Summary of Related Studies on Problems of Crippled Children*

*a. Problems of adjustment.* Elliott (1929, 16) pointed out that "the psychology of the handicapped can be understood only when considered in relation to the psychology of those with whom they come in contact" (p. 137). The cripple must be helped to acquire and maintain satisfactory relationships with the members of the society to which he belongs.

According to Crothers (1931, 12) more emphasis should be placed on the crippled child's assets; victims of infantile paralysis must be shown to be as intelligent as the normal. Abilities should be discovered early and plans laid for their training.

Kinder (1931, 37), in a study at the University of Pittsburgh, using the Woodworth Mathews Questionnaire, did not substantiate the common belief that crippled children are emotionally more unstable than the non-crippled. Adjustment to home and family was easier for them than for non-crippled children, and they were more sociable.

Ellis (1932, 18), in discussing adjustment of the handicapped, indicated that there is lack of knowledge of the problem, and of adequate facilities for diagnosis and treatment.

Wallin (1936, 73) stated—"If the defect does not cause a thwarting of the attainment of desires the defect may not result in maladjustment" (p. 64).

In a study of education of the physically handicapped, Teller (1937, 69) sent a questionnaire to former pupils of Spalding School in Chicago to which 52 replied. The majority stressed overcoming self-consciousness as a major problem in social adjustment, and the importance of more specific preparation for a vocation. More responsibility and training in self-reliance was also suggested.

Bradway (1937, 2) advocated objective methods for evaluating the level of the crippled child's behavior and a comparison of degree of maturity with that of children of the same age. Social responsibility was revealed by the extent to which one could manage not only his own affairs, but those of others. Expressions of social maturity<sup>o</sup> might be restricted by limited environment.

Emotional adjustments of the hospitalized child were studied by McGrew (1940, 45) who showed that the common fears of handicapped children were due to what they had heard at home and in school. Misconception and misinterpretation were important causes. In the lower social strata physical defects seemed to have less effect on parental attitudes.

Masten (1940, 44), in writing about defects due to infantile paralysis, indicated that harmful emotional disturbances result from environmental and sociological factors.

Street (1941, 67) reported that emotional instability occurs in few children who come from economically dependent homes. Its incidence is high when frustrations result because of mental, reading, or speech deficiencies.

Laycock (1942, 39), writing on the problems of adolescence of exceptional children, has emphasized the importance of social factors in a modern society which have molded the kind of life and culture which has developed.

*b. Effects of age of occurrence of defect.* There is disagreement concerning the effects of age at which crippling occurs on personality. Some writers state that the earlier in life it occurs the better the opportunity for the child to accustom himself to his dependence on others. If crippling occurs during adolescence, consequences may be more severe, and constructive training more necessary for molding and disciplining mental reactions.

Stafford (1939, 64) held conferences with over 200 crippled students at the University of Illinois and found that a large number did not understand aspects of their conditions. Trivial disabilities often produced severe conflicts. It was pointed out that if the handicap occurred at an early age satisfactory adjustment was usually attained by the secondary school age.

*c. Parental attitudes.* In regard to effects of parental attitudes, Coughlin (1941, 10) made a survey of children in the marginal income group. Conclusions were that the most frequent cause of a destructive attitude was ignorance of the parents concerning the emotional needs of handicapped children. She showed that cultural patterns were important in determining the attitudes of the parents. Variations in individual cases did not permit a classification of such attitudes.

Myers (1935, 52) stated that the handicapped child has more done for him in the home than the normal child, and that he is likely to grow less self-reliant. His behavior problems are no different from those of normal children, but more prevalent and more difficult to correct; the exceptional child may be the sibling and this is too often overlooked.

The importance of building a philosophy which accepts the disability has been emphasized by Deneck (1938, 14). Relationships of the child to the

family are important in the development of favorable or unfavorable attitudes which bear on the adjustment of the crippled individual.

There are children with physical disabilities who appear to be well adjusted socially and emotionally. The question arises as to whether the deficiencies of the crippled have been overemphasized. Perhaps those who work with the handicapped fail to see how they are normal. Perhaps crippled children meet their problems better than non-crippled children.

The physically handicapped child may either be subjected to over-attentiveness, or the opposite may be true, and he may be rejected by the family. In the latter case, there may be a lack of affection on the part of the parents for the child, who sensing his unpopularity becomes emotionally unstable, and draws impatience and hostility in his attempts to attract some kind of attention.

Parents can do much to help the crippled child minimize his difficulty; they can prevent the frustration which accompanies failure at difficult tasks by providing opportunities for successful accomplishment. Early recognition of his capacities, and an attempt to make the most of his aptitudes would aid in providing more successful social, and, particularly, vocational adjustment. Both parents and children should encourage contact of the crippled with non-crippled children.

Unsocialness is one of the most serious problems of child behavior. Crippled children may compensate for lack of social recognition. If pushed beyond ability a normal child may develop evasive behavior, day dreaming, or tendencies to rebellion.

*d. Mental hygiene.* Berry (1938, 4), in a discussion on mental hygiene pointed out, "To understand the exceptional child a twofold approach is necessary: the objective first, then the subjective" (p. 2).

In discussing psychological testing of the handicapped, Lávós (1941, 38) said, "the deaf, the crippled, the blind and others handicapped live and compete in a world of the physically normal, therefore, they should be compared with the normal. If the instrument used is designed to indicate possibilities of adjustment to a normal society then norms based on the non-handicapped should be used" (p. 4).

Deafness, speech, and visual defects, constitute prolific sources of mental conflicts and behavior disturbances. There is some question as to whether individuals with orthopedic defects, who do not live under as altered environmental conditions, would differ from normal individuals in social adjustment to any great degree. If the crippled child has taken a sensitive view of himself and realized his limitations his social adjustment may be adequate; it is even

possible that he could be encouraged to develop socially desirable qualities and other excellent traits to offset any possible unfavorable social effects of his handicap.

*e. Intelligence and achievement.* If crippled children have normal intelligence, they should share life and work with the kind of children that they will have to associate with in everyday life. The crippled child may become a problem when his handicap prohibits him from competing in a society which is organized for average individuals.

Irregular attendance at school may have caused retardation so that the handicapped child may not have the common school experiences of other children. The mistake has often been made of classifying, for example, the blind, deaf, and the crippled in a single group, and administering to them tests which are based on the assumption that the individuals who take them have had the common experiences of other children. The results have tended to place crippled children in the lower brackets, and cannot be considered adequate for yielding results which would be comparable to scores made by non-crippled children.

There are conflicting views about the effects of physical defects on school progress. Although deformities have delayed the crippled child's entrance in school, special attention which he may receive because of a late start may partially compensate for this situation. In any case, his social experiences are apt to be more limited than those of non-crippled children because he does not get around as well, and his view of his surroundings is necessarily more narrow.

Fernald and Arlitt (1925, 21) pointed out that the mean intelligence quotient of a group of crippled children whom they studied was lower than that of their siblings, but not significantly so; this group was not representative of all such children.

Lee (1931, 40), in a similar study, concluded that it was possible that they might be of inferior intelligence in spite of the handicap.

In studies by Nilson (1933, 53) mental inferiority of disabled pupils over non-disabled was not warranted.

All children have certain emotional needs including affection, activity in the right direction, and an opportunity for achievement which will give them self-confidence. Discrepancies between their abilities and grade school programs may result in lack of achievement which is a common cause of maladjustment.

*f. General abilities and attitudes.* In a study of abilities and attitudes, Jones (1932, 35) surveyed schools for handicapped children throughout the

United States to get reactions of instructors to school and social relationships. Intelligence quotients were higher in the poliomyelitis and tubercular cases, and those of girls were higher than boys. There was a year of retardation in school. Different types of disease did not produce unfavorable attitudes on school work.

In a discussion of morale development of the child, Wallin, (1936, 73) has stressed the importance of concern for development of activities in which the individual can excel.

Physically handicapped pupils cannot take part in all play activities, especially those involving strenuous physical exercise. They are, therefore, deprived of opportunities for exercise of physical powers, and the social contacts of play groups which aid personality and, consequently, social development. They cannot enter normally into the activities of others. There has been little research in this field; extensive studies of the mental and emotional lives of the handicapped by appropriate methods are needed.

If the crippled child has been deprived of competition in free play he is liable to grow up with a lack of initiative and of self-confidence. He may be intensely sensitive, and may tend to day dreaming because of his sense of inadequacy.

To combat these tendencies crippled children should be given an opportunity to engage in free play in which success in overcoming obstacles or in competing with others will to a certain extent be assured. Special schools provide free play where these children are with companions with whom they can compete on equal terms. A sense of achievement will help them to overcome some of their behavior difficulties if they are inclined to inferiority. Schools have to counteract effects of indulgence of parents, special considerations, or slights of playmates, which do not aid in normal resistance to outside influences.

Bruno (1929, 7) showed the importance of finding and developing a crippled child's particular talent or ability.

The importance of providing for creative activity and self-expression was also stressed by Strauss (1932, 66). There should be opportunities to develop initiative and to overcome self-consciousness.

Green (1936, 29) made a study to determine how the interests and personality traits of crippled children differed from those of non-crippled children. The children of Terman's *Genetic Studies of Genius* were used as a control. Conclusions were that the children studied were alike in more traits than they were different. The fact was brought out that the crippled were higher in mechanical ability than the non-crippled children. Both

chose the same vocations, reading interests were similar, but on the part of the crippled there was less liking for school subjects.

Rogers and Thomas (1938, 59) emphasized the importance of development of motor skills, entrance into group activities, exposure to social situations, development of interests, stress on creative work, and expression of thoughts in poetry.

Mendenhall (1940, 46) stressed the influence of the arts on the lives of handicapped children and the importance of developing creative activities.

In an exploratory psychological study of crippled children, Kammerer (1940, 36) showed that there is a lack of experimental evidence concerning adjustment of the crippled child. Duration of the defect did not seem to have any effect on personality development. Good family but poor social relationships were indicated. Retardation in school was slight, and defects had no effect on mentality in the cases studied. More intensive analysis of each case was advocated, and more emphasis on socially desirable behavior. Social and personal inferiority were not always traceable to crippling. Occurrence of maladjustment could not alone be attributed to crippling, but was dependent on a combination of influences.

*g. Vocational guidance.* In a study of vocational guidance and vocational education for crippled children, Musser (1933, 51) showed that successful employment was obtained by crippled individuals, particularly in mechanics, commercial and office positions.

Hughes (1934, 34) emphasized the necessity and importance of early discovery, treatment, and training, according to capacity of physically handicapped children whom she studied, and from the standpoint of benefits derived from a program of special education according to their particular needs.

Faulkes (1936, 20) indicated that investigations must be provided in individual cases to discover remaining physical abilities, to survey personality, aptitudes and interests, in order to provide the necessary educational experiences for adequate vocational preparation.

The review of previous studies has shown a scarcity of reliable information concerning social adjustment of children crippled by orthopedic defects. The present study attempts to discover by controlled experimentation whether there are special problems of social adjustment among crippled children, what such problems may be, and what suggestions for their prevention or treatment may be indicated. The investigation is conceived as an exploratory study using intensive treatment of a relatively small number of girls and boys. The writer hopes that this exploratory study will lead to more exhaustive programs of research in the field. Suggestions for such research will be discussed in the closing chapter.

## 2. Survey of Present Practices and Opinions

A questionnaire was sent to the director of each state department in charge of services to crippled children to obtain opinions on the importance of social and emotional adjustment, and to get facts on practices in the various states in regard to this problem. Responses indicated conflicting judgments and a real lack of verified information about the adjustment problems of crippled children. Table 1 summarizes replies to the questionnaire.

It will be noted that 20 or 45.5 per cent of those contacted stated that

TABLE 1  
SURVEY OF OPINIONS ON SOCIAL AND EMOTIONAL ADJUSTMENT OF CRIPPLED CHILDREN

1. Do you find that social and emotional adjustment is a major problem in the education of the crippled child?				
Yes	No	?	No provisions or evidence for	
20	12	3	9	
2. If question one is answered "yes" do you think that the crippled child's problems are more acute than those of normal children?				
Yes	No	?	No provisions or evidence for	
16	3	1	0	
3. Can you cite specific evidences (studies published or unpublished) which support your answers to questions 1 and 2?				
Yes	No	?	No provisions or evidence for	
8	24	0	12	
4. If question 3 is answered "no" upon what specific observations have you reached your judgment about questions 1 and 2?				
Observation Experience	Opinions of others	Published studies	No provisions or evidence for	
15	1	0	8	
5. If question 3 is answered "yes" cite any studies or specific evidences known to you, but not available in published literature.				
Published materials	Observation Case histories	No evidence		
3	4	1		
6. What, if any, special administrative provisions are made in your state which recognize the social and emotional needs of crippled children?				
None	Limited	Social or medical social service	Clinics or welfare dept.	No comments
13	6	15	7	3

social and emotional adjustment is a major problem in the education of the crippled child; that 12 or 27.3 per cent replied that it is not a major problem; the remainder either did not respond or stated that they had no evidence for any answer. Responses revealed that 24 or 54.5 per cent of those contacted reported that they could not cite specific evidences in support of their judgments about the social and emotional adjustment of crippled children.

### 3. *The Present Investigation*

Special opportunities were available at the University of Chicago Clinics for conducting a controlled study of crippled children. Subjects could be secured from referrals to the orthopedic division of the hospital center. The social, psychological, and psychiatric records contained pertinent information on the individual children. Facilities for the administration of tests and for other clinical procedures were at hand.

A study, therefore, was designed to answer this question: Do crippled girls and boys differ significantly from non-crippled girls and boys in their social and emotional adjustment?

While the central interest of the study is to gain evidence toward answering this question, comparative information was also gathered concerning reading and school achievement, vocational and avocational interests and plans, and manual abilities. It was thought that such information might be helpful in interpreting adjustment problems of crippled children, if such problems be found.

## B. PROCEDURES

### 1. Subjects

*a. Selection and description.* The crippled subjects who coöperated in this investigation are typical of the girls and boys of the Chicago area who come to the University of Chicago Clinics for medical or surgical treatment. They were selected from those referred between September, 1939, and May, 1940, by the Social Service Division for psychological study preliminary to making arrangement for counsel on their vocational plans. In selecting them, feasibility of securing control cases was a factor which had to be considered.

Data on the crippled and the non-crippled girls and boys with whom they were matched were obtained, with the exception of hospital records, by the same procedures, i.e., interviews, questionnaires, and home visits.

The distribution of causes of crippledness is given in Table 2. With the

exception of two of the crippled girls all of the subjects have defects which are readily noticeable. Only one has an arm defect; 11 have one or both legs severely affected, and four have marked spinal curvatures.

TABLE 2  
DISTRIBUTION OF CAUSES OF DEFECTS

Causes	Number
1. Poliomyelitis	5
2. Osteomyelitis	3
3. Scoliosis	2
4. Tuberculosis	2
5. Congenital	3
6. Cardiac	1
7. Traumatic	2
Total	18

Pertinent data collected with respect to each of the subjects used in this study included:

1. Age.
2. Defects.
  - (a) Cause.
  - (b) Age at Onset.
  - (c) Percentage of Life Crippled.
3. Racial Descent.
4. Religion.
5. Occupation of Parents.
6. Number of Siblings.
7. Socio-Economic Status.
8. Years of Schooling.
9. School Course.
10. Scholastic Achievement.
11. Vocational Interests.

An examination of scholastic achievement of the subjects showed that the non-crippled girls and boys had, on the average, better records than the crippled. There were six in each case who did average work. However, in the crippled there were six below average, as compared to two in the non-crippled group. There were only six above average in the crippled as compared to the 10 cases in the non-crippled group. The fact that the crippled did poorer than non-crippled boys has accounted for this difference since the girls did equally as well in both groups, and better than the boys. In the siblings, girls did better than boys, and the non-crippled subjects did better than the crippled.

To secure the information on school achievement, school principals were contacted, and where this was not successful, the social case record on achievement was used. Scholastic achievement may be compared with the mean intelligence quotients for the different groups by referring to Table 4. It will be noted that the mean intelligence quotient of the crippled siblings is 106.29, of the non-crippled siblings 104.14. The mean intelligence quotient of the crippled non-siblings is 115.09, of the non-crippled non-siblings 113.00.

The crippled subjects have, for the most part, attended special schools, if not entirely, at least for a period of time immediately following the onset of their crippledness. Four of the girls and boys were registered in the commercial course, three in vocational, one in science, and the others in the general course. Of the non-crippled there were three in commercial, one in vocational, two in science, and the rest in the general course. Vocational interests of the subjects varied widely.

In this study the socio-economic status of each home was estimated from data secured on record sheets filled out by the subjects, from home visits made by the writer, and from information in social case histories; in no case was the status above average. Evaluation was based on such factors as: occupation of parents, income level, material wealth, and location of home, racial descent and amount of schooling of parents.

TABLE 3  
OCCURRENCE OF DEFECTS IN CRIPPLED SUBJECTS

Crippled	Mean in years		Percentage of life crippled
	Age at onset of defect	Length of time crippled	
<i>Sibling</i>			
Girls	3.00	17.25	84
Boys	6.67	11.33	62
Average	4.57	14.71	74
<i>Non-sibling</i>			
Girls	5.00	12.80	69
Boys	11.00	7.67	41
Average	8.27	10.00	53
<i>Total</i>			
Girls	4.11	14.78	75
Boys	9.56	8.89	48
Average	6.83	11.83	61

Table 3 shows the mean age at onset of defects, and the mean length of time the subjects have been crippled. It will be noted that for girls the mean age at onset was 4.11 years, and for boys 9.56 years, making an average age of 6.83 years. The mean length of time in years for the girls,

was 14.78 years and for the boys 8.89 years, making an average of 11.83 years. Percentage of life crippled was, therefore, more for the girls, i.e., 75 per cent as compared to 48 per cent for the boys, making an average of 61 per cent, and it was higher in the sibling than in the non-sibling group.

Table 4 shows the mean ages, amounts of schooling, and *IQ*'s for both the crippled and the non-crippled. The mean age of the crippled subjects was

TABLE 4  
COMPARISON OF MEAN AGES, AMOUNTS OF SCHOOLING, AND *IQ*'s OF SUBJECTS

Subjects	Mean		
	Age	Years of schooling	<i>IQ</i>
<i>Sibling</i>			
Crippled	19.29	10.57	106.29
Non-crippled	16.43	10.43	104.14
<i>Non-sibling</i>			
Crippled	18.27	11.18	115.09
Non-crippled	17.18	11.09	113.00
<i>Total</i>			
Crippled	18.67	10.95	111.67
Non-crippled	16.89	10.83	109.56

18.67 years, of the non-crippled 16.89 years. There is no appreciable difference in mean amount of schooling, and retardation because of extended illness may account for the older age of the crippled in view of their school placement. This is not so marked in the boys, but the trend is in the same direction and agrees with accounts in the literature which have shown that crippled children are apt to be retarded in school. The mean *IQ* for the crippled subjects was 111.67, for the non-crippled 109.56.

*b. Method of pairing.* In a controlled study of this type there were the usual problems of sampling. The difficulty of securing a large number of comparable pairs of crippled and non-crippled girls and boys need hardly be explained. It is rarely possible to get the combination of available subjects, testing facilities, and measures available at the University of Chicago Clinics, at a single place, over a period of time of such length as this study permitted.

Of the 18 crippled girls and boys chosen for this special study, seven were paired with non-crippled siblings; 11 who could not be paired with siblings, were matched with non-crippled children of similar family background. Because of more precise control in the case of the paired siblings they were treated as a separate group.

The bases for matching the crippled non-siblings with non-crippled individuals were: age, sex, amount of schooling, and socio-economic background.

The socio-economic background was judged similar from data on clinic records, data on a form sheet which the subject filled out, and by visits to the homes. It was attempted, in so far as possible, to insure that the homes were, on the basis of objective factors at least, very little different in respect to conditions thought likely to produce social and emotional maladjustment.

Exactness in the matching of human beings is never absolute. The strength of investigations following this method of research depends upon the ability of the investigator to closely approximate an equating of his cases upon factors likely to have a critical effect upon the phenomenon which he is observing.

In this study then, to the extent that factors other than orthopedic defects, which might produce differences between crippled and non-crippled individuals, were well controlled, it might be argued that differences which were observed between them could be traced to the orthopedic defects. While the controls used were imperfect, they were believed to be as effective as the total circumstances of the study permitted, and were typical of controls used in other such studies. This study proceeded on the assumption that usable evidence might be obtained through careful examination and observation of the performance of fairly well controlled pairs of related crippled and non-crippled subjects.

Separate analyses were made of the (a) crippled children paired with siblings, and (b) crippled children paired with non-siblings. While this reduced still further the size of the samples used, it was believed that the small number of cases was in part compensated for by an increased precision in the controls provided.

## 2. *Materials*

*a. Tests.* The tests listed in Table 5 were given to both crippled and non-crippled subjects.

*b. Autobiographies.* The subjects were asked to write autobiographies and the directions were to give a brief account of incidents or happenings which they felt had been important in determining their opinions, ideals, viewpoints or vocational plans. An analysis was made of these autobiographies (optionally written) with a view to gaining additional information on social attitudes as expressed in a situation in which the responses were not controlled.

## 3. *Studies of Individuals*

Each of the pairs of siblings was studied by the case study method to discover whether information on the effects of the handicaps on behavior

TABLE 5  
MEASURES

1. Revised Stanford Binet (L) 1937 Edition	8. Iowa Silent Reading Tests Advanced Form A.M.—High School and Col- lege Elementary Form B, Grades 4-9
2. Kent Shakow Industrial Formboard	9. New Stanford Achievement Test Ad- vanced Examination Form V. Grades 4-9
3. Minnesota Manual Dexterity	10. Myer-Ruch High School Progress Test, Form A
4. O'Connor Tweezer Dexterity	11. Specific Interest Inventory Stewart Brainard
5. Washburne Social-Adjustment Inventory Thaspic Edition	12. Personality and Interest Inventory (Hildreth) 1936 Edition
6. Maller Case Inventory Third Edition Form A	13. Occupational Orientation Inquiry (Wallar-Pressey) 1939 Edition
7. Test of a Knowledge of Social Usage (Strang)	

might have been obscured by the more objective data. It was felt that a comparison of sibling pairs, where factors had been best controlled, might disclose new information on the effects of crippling on social and emotional adjustment.

### C. ANALYSIS OF RESULTS

#### 1. *Comparisons of Siblings*

*a. Social adjustment—Siblings.* The objective tests of adjustment used in this study are designed to give measures of traits highly correlated with social and emotional adjustment. The Washburne *Social Adjustment Inventory* is designed to give separate measures of several traits as well as a rating of adjustment in all of them combined.

The Maller Case Inventory consists of four tests designed to differentiate between well and maladjusted individuals. In addition to emotional and personal-social adjustment there are divisions on honesty and ethical judgment. A final section on background provides information on socio-economic status. The Strang *Test of a Knowledge of Social Usage* furnished information on opinions on behavior in social situations.

In a comparison of crippled and non-crippled siblings on these measures it was noted that none of the obtained differences reached a statistically significant level<sup>2</sup> sufficient to indicate that the crippled differed from their

<sup>2</sup>The "t" test of significance, as described by Lindquist (41), has been used throughout this study.

siblings on these measures of social and emotional adjustment. The closest approach to a significant difference appeared on Happiness and Control in the Washburne Inventory where a significance level of 10-20 per cent was found.

On seven of the 16 measures the differences were in the direction of a more favorable adjustment for the crippled children. There was a slight tendency for them to score less favorably on the personal adjustment aspects of the test as compared with work and school relationships.

The direction of differences, though they were too slight to be significant, was in favor of the crippled subjects on the personal-social adjustment score of the Maller Test, and on the *Strang Test of a Knowledge of Social Usage*.

Scores on Happiness and Alienation in the Washburne, and on Emotionality, Honesty, Ethical Judgment, and Total Adjustment Score on the Maller Test were in the direction of a less favorable adjustment in the crippled children.

Work and school adjustment scores for the crippled on the Washburne, and Personal-Social Adjustment on the Maller, when compared to the norms, were within the average range for non-crippled individuals.

The Personal-Social Adjustment score of the crippled on the Washburne lowered the total score, and placed them at the lower end of the average range of adjustment as measured in normally adjusted individuals.

*b. Interests—Siblings.* The majority of the obtained differences in interests were not significant. The only statistically significant differences, even at the 5 per cent level, were in the interests in manual tasks which crippled children favored, and in outdoor activities in which they expressed little or no interest.

They tended to prefer mechanical activities more than did the non-crippled. Dislike was expressed for physical activities, art, and vocal expression.

The crippled children did not show as much liking as the non-crippled for physical, music, art, and such activities as involve leadership, social, and vocal expression. In those interests, however, they were not found to be significantly different from their siblings.

*c. Manual ability—Siblings.* The Minnesota Manual, the O'Connor Tweezer, and the Kent-Shakow Formboard, were the tests used to measure manual ability.

As noted in the discussion on interests, the crippled tended to favor manual and mechanical tasks. A comparison of the crippled and non-crippled siblings on the tests of manual ability showed no statistically significant differences between the groups on these measures. The closest approach to a reliable

difference was in the scores on the Minnesota Manual and the O'Connor Tweezer Test which showed the crippled subjects at a disadvantage.

Although crippled children were interested in manual and mechanical activities, there was some indication that they did not score as high on strictly manual tasks as did the non-crippled.

## 2. Comparisons of Non-Siblings

*a. Social adjustment—Non-siblings.* Eleven crippled children were compared with their matched pairs on the Washburne *Social-Adjustment Inventory*, Maller *Case Inventory*, and the Strang *Test of a Knowledge of Social Usage*.

It was noted that on the Social-Adjustment Inventory, except for the section on Purpose, the crippled subjects had more favorable scores. The differences between their scores and those of their pairs, however, were not statistically significant.

On the part of the Maller *Case Inventory*, designed to measure Emotionality, the crippled girls and boys seemed to show more symptoms of emotional maladjustment, this difference being significant at the 2-5 per cent level. It was noted, however, that even though these differences were found, the score of the crippled children was still within the range of normal adjustment as defined by the norms of the test. The differences were in part traceable to the unusually high score made by the control group.

The crippled did not score as high on honesty, total adjustment, and social usage as the subjects with whom they were matched.

*b. Interests.* On the Stewart-Brainard *Specific Interest Inventory* the crippled subjects expressed an interest in order, leadership, esthetic, outdoors, literary, music, study, commercial, and physical activities; they cared little for mathematics, art, and experiment.

The non-crippled showed the greatest amount of interest in order, outdoors, study, esthetic, leadership, and social activities and disliked art and mechanical tasks.

The crippled showed little interest in activities that involved leadership, social, and vocal expression. They liked commercial, literary, mechanical, art, esthetic, and physical activities. In none of the interests were the crippled non-siblings found to differ from the subjects with whom they were paired.

*c. Manual ability—Non-siblings.* There were no significant differences in manual ability, but the crippled subjects tended here also to be at a disadvantage on strictly manual tasks.

*d. Achievement and reading.* Comparisons in both groups were also

made on achievement and reading. On objective measures the crippled siblings placed at the 48.5 percentile in achievement as compared to 26.6 for their brothers and sisters. A tendency for a less favorable showing was apparent in the non-siblings. The crippled subjects placed at the 40.8 percentile in achievement in contrast to 60.9 for the control class. This agreed with a similar tendency which was noted in the school records reported by principals.

The crippled siblings were slightly better in reading rate, but not as good in comprehension, in which they placed at the 27.4 percentile in contrast to 58.1 for the non-crippled.

In the other group there was again a tendency for the crippled subjects to do less well than the control cases, since they placed at the 37.7 percentile in comprehension as compared to 74.7 for the non-crippled subjects.

*e. Summary on comparisons of siblings and non-siblings.* A comparison of the results obtained upon the sibling groups with those obtained when the crippled children were matched with non-siblings showed some interesting agreements.

With one exception there were at the 5 per cent level no statistically significant differences in either group between the pairs of crippled and non-crippled girls and boys on the objective measures of social adjustment.

There was a tendency for the personal adjustment score of all children, both crippled and non-crippled, in the Washburne, to be lower than the work and school adjustment score. The score of the siblings was less favorable than that of the non-siblings.

Work and School Adjustment was average in both groups, and there was a tendency, though statistically unreliable, for it to be better in the crippled.

Because of the low placement of crippled siblings and non-siblings in the personal adjustment score, total adjustment scores, when compared to the standards for normal individuals, showed two groups to be within the average range, but low on the scale for satisfactory adjustment.

On the Maller Case Inventory, ratings on personal-social adjustment tended to agree with similar ratings on the Washburne and were in a direction favorable to the crippled.

Scores on emotionality, particularly in the non-sibling group, showed that the crippled tended to be less well adjusted.

With the exception of ethical judgment, which was in favor of the non-siblings, there was a tendency for poorer adjustment in the crippled on the other test divisions of the Maller Inventory. However, all placements on this measure came within the range of average for all individuals.

With the exception of two minor divisions in the sibling group, i.e., outdoors and manual tasks, there were no statistically significant differences in interests between the pairs of crippled and non-crippled subjects.

There seemed to be a tendency in both groups for the crippled subjects to take less interest in activities involving social relationships, such as appearing before an audience, and there was not much interest shown in strenuous physical activities. They showed a liking for literary and aesthetic pursuits. The crippled children also have considerable interest in manual and, particularly, mechanical tasks.

On strictly manual activities, although differences are not significant, there was a tendency for both groups of crippled subjects to do less well than the non-crippled. However, the range of manual ability was from normal to very low for all individuals when checked against the standards for average performance.

On the formboard tasks there was more variability on dexterity than capacity, though again, no appreciable difference could be shown between pairs in either group. But both groups rated above the norms for average individuals on these tasks.

The crippled children tended not to read or achieve as well as those with whom they were paired. The non-siblings had slightly higher percentile scores than the siblings.

With the exceptions which have been considered, the agreement of results in the sibling and non-sibling groups was useful as an indication of the reliability of the evidence found.

### 3. *Case Studies of Siblings*

Case studies were made of siblings in order to find out whether new information could be gained by a study of factors which might be contributory to adjustment, the effects of which may have been obscured in the group study based on objective measures.

a. *Summary—Case studies.* The case studies disclosed no cases of serious personal-social maladjustment. However, home conditions and attitudes in the family appeared to cause situations conducive to unfavorable adjustment. L.R., member of a sibling pair, may have had less favorable adjustment than her sister, M., because of her failure to achieve in school. But, evidence as a result of interviews and tests pointed directly to the family situation as a basic cause for her difficulties and her present personal-social adjustment status.

Variability of adjustment over a period of years and in various adjust-

ment situations is characteristic. Because of retardation K.A. was a problem in school and caused difficulties in the classroom when he had to associate with younger boys. Now he has a job, and since he has been able to achieve successfully, his adjustment status has been improved.

In some cases, as in A.B. and R.B., the non-crippled sibling might in certain respects show less favorable adjustment. R. seemed to have reacted against the concern of her family for her crippled brother's welfare by constantly striving for recognition in dramatics.

In the F. family, B., crippled, handled her problems well in spite of poor home conditions and inadequate help on her vocational plans. Her sister N. held several jobs, and there had been considerable rivalry over her success. Both girls have done well, but B. has particularly shown the effects of her poor home and unfavorable vocational status.

C.K., non-crippled, referred to her inability to go on to school like her sister. S., crippled, had more advantages and a much wider range of school and social experiences due to aid from state funds for a university education. C. lacked confidence and was shy and retiring in contrast to her aggressive older sister who had been favored by her family and her relatives.

V.M. and A.M. showed similar traits and abilities and were about equally well adjusted. They had definite vocational plans and took responsibility for helping at home. On objective tests both tended to be lower on personal than on work and school adjustment.

J.D. and R.D. came from a home in an unfavorable socio-economic area, but attitudes and family relationships, appeared to be satisfactory. They tended to show the same personal characteristics although R. was more aggressive than his sister. Both lacked confidence and J., crippled, had had much less opportunity for social and work experience. Their abilities and achievement status were very similar.

The case studies showed that the sibling might both be favorably or less favorably adjusted, and that tendencies in either direction might be a result of factors other than the presence of crippling. In some cases, evidence pointed toward home conditions and family relationships as important factors in determining adjustment status.

Personal adjustment did not appear to be as good as work and school adjustment.

Variability of adjustment status over a period of years and in various adjustment situations was characteristic.

There were no cases which evidenced serious personal-social maladjustment.

#### 4. *Analysis of Autobiographies*

Autobiographies, optionally written, were used to gain some insight into the attitudes which crippled girls and boys express about themselves and their plight. If crippledness produces marked effects and leaves vivid impressions, it was thought that such impressions would probably be related in an autobiography. These personal documents would then provide insight into the problems of the individual. The extent to which the subjects presented biased views of their problems was not known; selected episodes may have been colored by present moods and activities; emphasis may have been on unpleasant and unhappy aspects of life; these impressions in themselves cast interesting sidelights on personality and social attitudes. An examination of the autobiographies showed that certain conceptions and attitudes do exist. More emphasis was placed on the nature of the attitudes expressed than on an attempt to discover or explain causes for them.

The autobiographies were analyzed for indications of situations or conditions which would reflect the effectiveness of the individual adjustment, personal or social.

These suggestions were an outcome of the analysis of the autobiographies:

(a). The special school and the hospital sometimes provided a haven from unpleasant home conditions. Sometimes they were regarded as disagreeable places, and the attentions of the home were welcomed.

(b). The extent of dependency on parents was variable.

(c). Acquaintance with others of similar defect helped to promote favorable attitudes through competition and success in school.

(d). Financial and other difficulties in the home were responsible for some maladjustments, but not differentially so for crippled children.

(e). Acceptance of some type of responsibility, even though it might be an insignificant job at school, was a source for promoting self-confidence.

(f). Assistance on vocational plans and adequate help on adjustment problems was usually not available.

(g). Proper medical and surgical treatment was not provided.

(h). Desires to be treated as if non-crippled were prevalent.

(i). Active sympathy for other crippled children, with plans to engage in social service work, was occasional.

(j). The fact that many of the children showed an interest in medicine as a profession may reflect interests arising from hospitalization and long periods of medical treatment.

(k). Psychological escape from unhappy conditions through poetry and day dreaming were suggested.

(l). Like and dislike for teachers and school work appeared in normal amount.

(m). The attitudes toward their handicaps seemed at this age mature and philosophical.

In the accounts written by non-crippled subjects, mention of illness and physical defects was, of course, noticeably lacking. Misfortunes of this kind have not played a major rôle in their lives. Conditions suggesting effectiveness of adjustment as disclosed in these accounts may be summarized as follows, and showed principally:

- (a). Confidence in abilities and plans for a vocation.
- (b). Favorable attitudes toward school.
- (c). Desire to get ahead, and to achieve goals in school and life plans.
- (d). Ability to get along with siblings.
- (e). Some (but fewer than for the crippled children) difficulties in home relationships.
- (f). Lack of assistance in vocational planning.
- (g). Influence of parent's opinions in shaping plans for school or a vocation.

#### D. SUMMARY, CONCLUSIONS, IMPLICATIONS

A survey of the present status of opinion about and provision for the adjustment problems of crippled children showed that of the 44 state directors contacted, 45 per cent found social and emotional adjustment to be a major problem in the education of the crippled child.

Replies indicated that only 46 per cent could cite specific evidence to support their judgments. Their opinions were not based on the results of planned research though, perhaps, on careful observation.

State provisions for taking care of adjustment problems of crippled children ranged from no provisions at all to, in a few cases, well established clinical services.

A survey of previous studies on problems of crippled children disclosed few experimental studies, and a variance of opinion on the seriousness of the adjustment problems of crippled children.

The purpose of this study was to gain evidence as to whether crippled girls and boys differ significantly from non-crippled in social and emotional adjustment. A comparative study was made of 18 crippled girls and boys who were matched with non-crippled individuals of similar background. Seven of the matched pairs were siblings; the bases for matching the non-siblings were, age, sex, amount of schooling, and socio-economic background.

The scores made by the subjects on the various objective measures used disclosed no statistically significant differences between the crippled and non-crippled girls and boys in social and emotional adjustment. Both siblings and non-siblings rated lower on personal than on work and school adjustment. Their scores placed them at the lower end of the range for normally adjusted individuals. Work and school adjustment in both groups was average, and there was a tendency for the ratings to be higher in the crippled subjects. The crippled girls and boys, however, tended to score less favorably on most of the objective measures used, but the discrepancy from the scores of their siblings or matched pairs was not sufficient to accept as a reliable difference.

(The comparative studies of siblings and matched pairs, and the autobiographies, suggested that cultural backgrounds and personal-social relationships, particularly in the home, may affect personal-social adjustment more than crippledness. Certainly, physical defects do not inevitably cause maladjustment. This showed up most strikingly when both siblings were found to be favorably adjusted, and not greatly different from each other. They had similar abilities and interests, and tended to have the same patterns of strengths and weaknesses.

The autobiographies revealed that the crippled girls and boys have apparently made wholesome adjustments to their physical disabilities, and to the attitudes of their associates toward themselves, as persons. They have met and solved many of their own problems satisfactorily, can take responsibility well, and have definite vocational plans although guidance in this respect would seem to be inadequate. Satisfactory medical and surgical treatment was not always available when most needed.) Contacts in special schools were valuable in promoting confidence by providing opportunities for successful achievement in competition with others similarly handicapped.

(Although there were no statistically significant differences between the scores made by the crippled and non-crippled girls and boys on objective measures of social and emotional adjustment, evidence showed that some pairs of subjects were favorably and others unfavorably adjusted. The presence of crippledness in the family may have some effect on the adjustment status of all the members of the family. But the evidence seen in this study strongly suggests that crippledness seems not necessarily to presage maladjustment for children so affected.

This investigation indicated the need for more experimental studies on the traits and abilities of crippled children. (The factors which operate in each situation to produce desirable or undesirable social and emotional adjustment

are manifold and sometimes unique. How such factors combine in individual cases needs much more careful study than has yet been given.

In this connection problems for further study are suggested. <sup>2</sup>More consideration must be given to the effects of crippledness on personal-social relationships in the entire family, and how they affect adjustment.

- 3) This study concerned girls and boys with average to low socio-economic status. Would similar patterns of strengths and weaknesses in personal-social adjustment be evident in those who come from families of average to high socio-economic status?

It would be desirable to study adjustment status of crippled children before and after their crippling. Such a study presumes that accurate records could now be found to provide evidence of adjustment status before crippling.

- 4) A comparison of adjustment status of crippled and non-crippled children at various age levels might provide interesting material for comparative studies on levels of social and emotional maturity.

- 5) A follow-up study based on work and school relationships of crippled children who have attended special schools as compared with those in public schools might provide enlightening information on social and emotional adjustment.

6) More information on the crippled child's opinion of the effects of his defects on his own personality would be desirable.

- 7) The achievement and mental status of such children needs careful investigation by measures appropriate to their background and experience.)

A system of vocational guidance adequate for individual cases needs to be devised, and contacts should be made with the subjects early in life in order to follow through successfully with a program suited to their particular needs.

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# SHORT ARTICLES AND NOTES

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## BLOCKWRITING REVISED

*Cambridge, Massachusetts*

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The blockwriting devices described herewith are modifications of devices for registering choice with stationary or sliding frames.<sup>1</sup>

### STATIONARY FRAME (1) (2) (3)

A three-compartment tray with a roll of white gummed paper tape in the middle compartment, the tape crossing the floor of the left compartment, a block with a raised character on its base resting on an ink-pad in the right compartment, offers opportunity for practice in manipulation.

### SLIDING FRAME (3)

Figure 1 shows a sliding frame with a peg, a part of the left half of which has been cut away, resting in a wedge-shaped ratchet in the rod of a paper feed-roller.

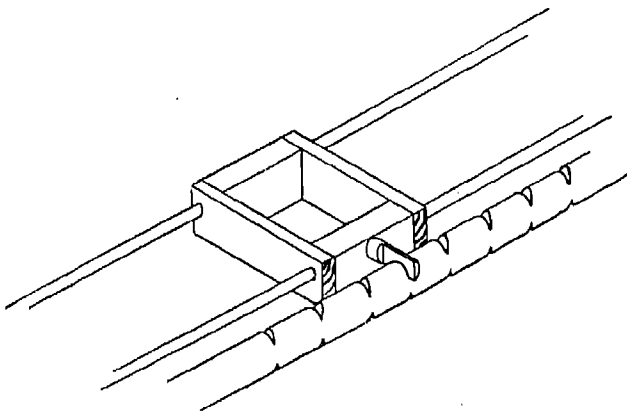


FIGURE 1

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<sup>1</sup>The writer gratefully acknowledges the examination of the materials by her former instructor, Dr. Walter F. Dearborn, Director of the Psycho-Educational Clinic, Harvard University.

Figure 2 shows a pawl engaging one of two notches in the rim of the left knob of the paper feed-roller. The pawl is held against the knob by a rubber band.

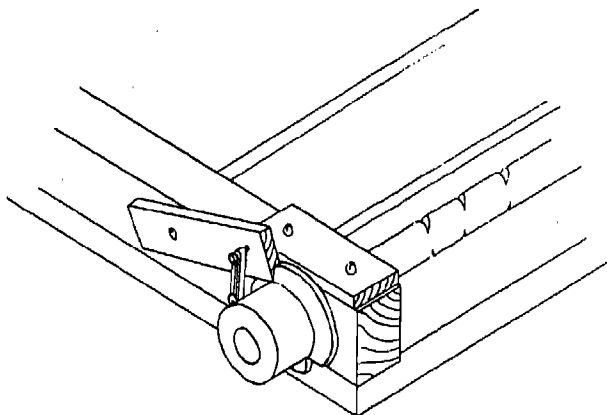


FIGURE 2

Figure 3 shows the platform of the blockwriting device with sliding frame and the rabets in which supports are set which serve as paper guides.

The rod of the feed-roller resting in slots in the supports is encircled by two tightly fitting rubber rings, one of which is shown close to the support at the right. This rod is held down in the slots by specially shaped blocks in the wings of which are screws which can be tightened or loosened.

Trays (5) filled with blocks which rest on continuous strips of inked felt separated by crosspieces are shown held together in tiers by cleats which are attached to them.

#### BLOCKWRITING DEVICE WITH SLIDING FRAME: ABRIDGED SPECIFICATIONS

Platform 12 in. x 9 in. x  $\frac{3}{8}$  in.; rabets  $\frac{1}{16}$  in. deep,  $\frac{1}{2}$  in. wide, exactly 11 in. apart.

Supports 9 in. x  $\frac{3}{4}$  in., left support  $\frac{1}{2}$  in. thick, right support, inner section  $\frac{3}{8}$  in., outer  $\frac{1}{8}$  in. thick; slots  $\frac{11}{16}$  x  $\frac{3}{8}$  in.; holes for frame rods in a line  $\frac{3}{8}$  in. above bases of supports,  $\frac{1}{4}$  in. and  $\frac{1-9}{16}$  in. from slots, outer section of right support undrilled; holes in left support  $\frac{1}{4}$  in. deep; cleats 8 in. x  $\frac{3}{16}$  in. x  $\frac{3}{16}$  in.

Feed-roller: Rod 13- $\frac{1}{4}$  in. x  $\frac{3}{8}$  in. D.; two rows of wedge-shaped ratchets, 19 in each row,  $\frac{1}{2}$  in. apart, 1st ratchet 1 in. from left support.

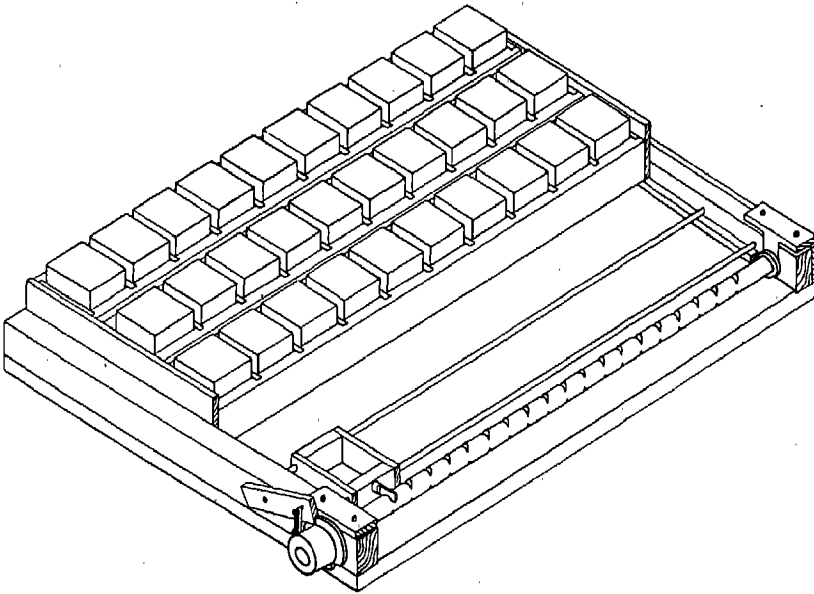


FIGURE 3

The ratchet consists of a cut perpendicular to the rod  $\frac{3}{32}$  in. deep which is joined by a slanting cut  $\frac{3}{32}$  in. or more to the right of it.

Rubber rings: Sections of tube  $\frac{1}{8}$  in. long having an inside diameter of approximately  $\frac{1}{4}$  in. and a wall thickness of approximately  $\frac{1}{16}$  in.

Winged blocks  $1\frac{3}{8}$  in. x  $\frac{1}{2}$  in. x  $\frac{1}{8}$  in., centerpieces  $\frac{1}{2}$  in. x  $\frac{3}{8}$  in. x  $\frac{5}{16}$  in.

Pawl  $1\frac{1}{2}$  in. x  $\frac{1}{2}$  in. x  $\frac{1}{8}$  in.

Knobs  $\frac{5}{8}$  in. x  $\frac{3}{4}$  in. D. with rims in addition; two right-angled notches in rim of left knob.

Sliding frame: Sides  $1\frac{9}{16}$  in. x  $\frac{1}{2}$  in. x  $\frac{1}{8}$  in.; ends  $\frac{15}{16}$  in. x  $\frac{1}{2}$  in. x  $\frac{1}{4}$  in.; peg  $\frac{3}{4}$  in. x  $\frac{3}{16}$  in. D.

Frame rods  $11\frac{5}{8}$  in. x  $\frac{1}{8}$  in. D.

Trays  $10\frac{3}{4}$  in. x  $1\frac{9}{16}$  in. x  $\frac{3}{4}$  in. (outside).

Cleats holding trays in tiers  $4\frac{7}{8}$  in. x  $1\frac{1}{16}$  in. x  $\frac{1}{8}$  in.

Blocks 1 in. x  $\frac{7}{8}$  in. x  $\frac{3}{4}$  in.

Special feed-roller for work-sheet has 10 shallow v-shaped grooves which encircle the rod, 1 in. apart, 1st groove 1 in. from left support.

## RULED PAPER FOR PREPARING WORK SHEETS (4)

Paper 8-1/2 in. x 11 in. with long side at the top.

Horizontal lines: 1st line 1/4 in. from top of sheet, lines alternately 1-1/16 in. and 1/4 in. from preceding line, a margin of 5/8 in. at bottom of sheet.

Vertical lines: 1st line 1/2 in. from edge of sheet, 10 lines 1 in. apart, a margin of 1/2 in. at the right.

Work sheets are used without the pawl.

## DIRECTIONS FOR ASSEMBLING PARTS OF THE DEVICE

1. After attaching cleats to supports 1/8 in. above bases of supports, attach supports to platform as in Figure 3.
2. After attaching pawl to left support, 1/8 in. from slot, place rod of feed-roller with rubber rings on it in slots, a row of ratchets on top as in Figure 3.
3. With pawl engaging notch as in Figure 2, screw left knob on to rod.
4. With frame on rods, insert rods in supports, attach outer section of right support and right knob.

## DIRECTIONS FOR OPERATING WITH BLANK PAPER

The device is screwed or clamped to a solid table, leaving both hands free. The present model requires paper 11 in. wide.

1. Insert paper under feed-roller and with both hands on knobs turn them counter-clockwise until the pawl clicks.
2. Holding the frame with the left hand, select a block with the right hand and place it in the frame.
3. With the left hand push the frame into the next ratchet as soon as the block has been lifted from the paper.
4. At the end of the line pull the frame with the left hand to the extreme left, first releasing the frame by turning the right knob slightly.
5. With both hands on the knobs turn them counter-clockwise until the pawl clicks.

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4. ———. The sliding frame: ruled paper for use in preparing work sheets.  
Ibid., 1943, **62**, 335-336.
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## BOOKS

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The *Journal of Genetic Psychology*, the *Journal of General Psychology*, and the *Journal of Social Psychology*, will buy competent reviews at not less than \$2 per printed page and not more than \$3 per printed page, but not more than \$15.00 for a single review.

**Conditions.** Only those books that are listed below in this section are eligible for such reviews. In general, any book so listed contains one or more of the following traits: (a) Makes an important theoretical contribution; (b) consists largely of original experimental research; (c) has a creative or revolutionary influence in some special field or the entire field of psychology; (d) presents important techniques.

The books are listed approximately in order of receipt, and cover a period of not more than three years. A reviewer must possess the Ph.D. degree or its equal in training and experience.

**Procedure.** If among the books listed below there is one that seems important to you, you are invited to write a review of that book. It is not necessary to make arrangements with the Editor. Just send in your review. It does not matter if the book in question has been reviewed before.

(1943)

- GESELL, A., & ILG, F. L. *Infant and Child in the Culture of Today*. New York: Harper, 1943. Pp. 399.
- LEPPER, R. W. *Lewin's Topological and Vector Psychology*. Eugene: Univ. Oregon, 1943. Pp. 218.
- YERKES, R. M. *Chimpanzees: A Laboratory Colony*. New Haven: Yale Univ. Press, 1943. Pp. 321.
- YOUNG, P. T. *Emotion in Man and Animal*. New York: Wiley, 1943. Pp. 422.
- MASSERMAN, J. H. *Behavior and Neurosis*. Chicago: Univ. Chicago Press, 1943. Pp. 269.
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- ESTABROOKS, G. H. *Hypnotism*. New York: Dutton, 1943. Pp. 249.
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- MCGRAW, M. B. *The Neuromuscular Maturation of the Human Infant*. New York: Columbia Univ. Press, 1943. Pp. 140.
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- FLÜGEL, J. C. *Man, Morals, and Society*. New York: International, 1945. Pp. 328.
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- WERTHEIMER, M. *Productive Thinking*. New York: Harper, 1945. Pp. 224.
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- MASSERMAN, J. H. *Principles of Dynamic Psychiatry*. Philadelphia: Saunders, 1946. Pp. 322.
- SEWARD, G. H. *Sex and the Social Order*. New York: McGraw-Hill, 1946. Pp. 301.
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## CRITICAL REVIEWS OF RECENT BOOKS

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*The Journal of Genetic Psychology*, 1946, **68**, 253-264.

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REVIEWED BY W. DRAYTON LEWIS

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A fundamental need in the training of students in child psychology is that of acquainting them with the contributions, the techniques, and the methods of research. A beginner, who is not familiar with research and who has not had sufficient training and experience to enable him to evaluate the studies which he reads, often wastes much time and tends to become lost in the wilderness of studies. It does not seem wise to turn a beginner loose to wander in this maze without some guidance, or without some spade work having been done for his benefit. The volume under consideration should prove of aid in implementing the process of introducing the beginner to research in child development.

The volume should also be of assistance where library facilities, as far as journals and monographs of research are concerned, are limited, not readily accessible, or not present in sufficient quantities to meet the needs of the students. This collection of studies should have a wide field of usefulness although, of course, its value will vary with the instructional policy of the teacher as well as with the ability and level of development of the students. It is doubtful if students profit much from studying such a collection of research unless they are fairly able, mature, and well trained in scientific procedures.

The editorial policy pursued in constructing this volume is fundamentally sound. The editors, in order to obtain as representative a selection of the research in the field of child development as possible, directed inquiries to 110 members of the Society for Research in Child Development requesting each member to "list the six studies in child behavior and development which in his judgment it would be most desirable to present in a book of basic reading material for college students." The nominations received represented most, but not all, of the principal areas of research. The fact that some studies in the same field received the same number of votes necessitated editorial selection. Other studies were chosen, not because they received a large number of votes but because the editors felt that it was

necessary to include them in order to give a more thorough coverage of the field. Certain European studies were selected by the experts but had to be omitted because of difficulties of correspondence due to wartime conditions.

It is not to be expected that many, if any, teachers in the field of child psychology will agree wholly with the choice of studies and many will feel that some of the most important research in the field has been omitted. This collection of research, however, will probably prove about as satisfactory, on the whole, as any that might be put together in the space of one volume. Many will find that some of their pet studies have been omitted and, for that reason, will feel that the volume does not meet their needs. That, of course, would be true of any single volume of studies.

The editors set out "to pack a fairly complete reserve shelf between the covers of one volume." Those instructors who feel that this has been accomplished will be able to use this volume as the editors hoped that it will be used, that is, as the basic text in a course rather than as collateral reading material. Many instructors, however, will find the volume useful only as collateral reading material.

Experience appears to indicate that a text of this type cannot be used successfully with college students until they are fairly well grounded in the fundamentals of child development or unless they are an unusually able group of students well versed in scientific procedures. The probability is that this volume will be found to be more useful with graduate than with undergraduate students, although many will find it useful as collateral material for less mature students. It must be recognized that this type of text places a relatively heavy burden upon the instructor since there are gaps in the material and, as a rule, only one side or phase of the picture is presented. Many graduate instructors will prefer that their pupils go to the original studies rather than use the condensed versions to be found here. The volume could be of value to prospective Ph.D.'s preparing for comprehensive examinations who desire an overview of typical research in child development and behavior.

The editors express the hope that they have done something by way of bridging the gap between the scientific laboratory and the reading public. It is entirely desirable that the findings of scientific research relative to child development and behavior be made available to the reading public and this volume should be of some aid in so far as it has put some of the research in a more readable and accessible form. Some of these studies, however, are so over-laden with statistics, schematic representations, and theoretical considerations that they will be intelligible to relatively few readers.

The editors state emphatically that the studies presented in this volume are not intended to be "essays *about* research." "Each of them is an account of the procedure, results, and conclusions of a particular investigation." The purpose is not to present the findings of research but the processes and methods of research. The several writers realized these aims with varying degrees of success. Some writers emphasize the methods and techniques which were used in their research, subordinated findings and conclusions, others emphasize the theory which motivated the research, whereas still others emphasize findings while subordinating methods and techniques. The last two studies in the volume are almost wholly summaries of findings. Methods and techniques are subordinated to such a degree that they must be largely inferred.

Many teachers will, without doubt, find that this volume does not provide an adequate presentation of the work in certain fields, or that important fields are omitted altogether. This, in many cases, will make it undesirable as a basic text, or militate against its use for more than collateral reading. There is no systematic presentation of sex differences, which are only dealt with quite incidentally in some of the studies. There is no research presented on children's interests, a crucial subject in the field of education today, on aesthetic or moral development. The important field of emotional development is represented only by studies on fears and frustration. There is only one study on motivation. The only study dealing with exceptional children is a brief review of Terman's work on gifted children.

Some of the studies are so condensed that many teachers will feel that they do not do justice to the original research. The review of Terman's work on gifted children is an excellent example of this. Some of the studies are, for many purposes, in a more readable and useful form as far as the needs of many readers are concerned. The volume will probably be quite useful where the aim of the reader is to obtain a general introduction to or a general impression of research in the field of child development and behavior and of techniques and methods which are being used in the investigations. Those who desire to become well versed in methods and techniques of research and to become familiar with the findings of research will probably find it more profitable to turn to the original reports rather than to depend on the condensed versions to be found in this volume.

The weaknesses of this volume, other than those cited above, are, to a large degree, those of psychological research in general. Several of the studies are over-burdened with statistics that add little to the reports and, to a degree, serve only to make them unreadable. Statistics have been of untold

value in psychological research but they, all too often, have become "the tail that wags the dog." One of the greatest gifts that a reporter of research can possess is to have the courage to discard statistics that add nothing to the investigation, or, at least to dismiss them with a sentence or two. Too many investigators cannot persuade themselves to leave unpublished statistical work even when it proves to be of no value. Another weakness revealed in this volume is that some investigators have been unable to lay aside the shackles of other sciences but remain enslaved to, or intentionally imitate their terminology and mode of presentation. This does not make for intelligible psychological reporting. Too many investigators have not learned to write and are not good reporters. This weakness is evident in more than one study included in this volume and the reader is left confused on more than one occasion.

The opening chapter, an essay by Lawrence K. Frank, is an historical sketch on the development of research in child psychology. Studies in child psychology, it is pointed out, have reflected "the major preoccupations and methodological predilections that were present during the early course of its development." The first systematic attempts at child study, beginning in the second decade of the present century, were focused primarily upon the study of specific traits and capacities and were characterized by a search for methods that could be considered purely quantitative and objective, a characteristic shared with American psychology in general.

Frank points out that, at one time, this search threatened to engulf child study since it became the chief ambition of many investigators and threatened to obscure concern for children themselves. This was a threat to the development of child psychology in so far as there was a tendency to omit problems which were not susceptible to psychometric formulation and approach.

At the height of this activity child psychologists seemed bent upon "substituting statistics for insights" and ignoring, if not denying, other aspects of child behavior that could not be brought within the prescription of a standardized test (2).

The tremendous prestige of statistics resulted in studies of large populations of children to satisfy the desire for statistical reliability and norms. The individual child was almost lost in the scramble and, in the end, very little was known about individual children.

It is to be noted that attention tended to shift to the child again as a result of two lines of work which slowly developed largely outside the main movements in child psychology but which finally became quite significant

in the field of child study. The first was the interest of anatomists and pediatricians in the problem of physical growth and the second the concern of workers in child guidance clinics with the behavior problems presented by individual children.

Frank points out that the work of the anatomists and pediatricians, in studying the various aspects of physical growth and development, led them to see that norms could not be applied successfully to individual children. This aroused a growing suspicion of norms and led them to believe that the emphasis should be shifted from "measurement to an examination of textures, configurational patterns, and other evidences of advancing development and maturation." This viewpoint came to be accepted by many child psychologists.

The clinician was emphasizing the individual, as against the child psychologist who tended to center attention upon norms. He recognized that norms and other quantitatively derived standards had their place but insisted that they be scrutinized in the light of measurements, assessments, and life history of each individual. As a result of the two approaches, the psychometric and the clinical, a rift tended to develop in child psychology "between those who continued to construct, elaborate, and refine standardized tests through the manipulation of the data obtained from children they rarely, if ever, saw, and the clinical psychologist who examined specific children for diagnostic and remedial purposes, as in counseling and guidance." Frank holds that the major contribution of workers in child guidance is the idea that the results of standardized tests must be clinically interpreted in the light of the child's life history and background.

Students of somatic development are said to have contributed two ideas: (a) that the sequence of growth from conception to early childhood is an orderly path; (b) that each individual has a well defined sequence of growth at a unique rate.

Studies in physical development, it is stated, have made an important contribution to child psychology by emphasizing the fundamental importance of vitamin and nutritional deficiencies in child development. Their work suggests that the performance of children on standardized tests and in academic work may be compromised by sheer nutritional deficiencies, that norms of physical development reflect all the "sins of omission and commission in child nature." It is implied that students of child development have paid too little attention to nurture, particularly prenatal nurture, especially in the case of low-grade and retarded mental capacity.

Frank, in view of these important contributions which have forced their

way into child psychology, issues the following "ultimatum" which is worthy of the careful consideration of all who are interested in the development of research in child psychology.

In the light of the foregoing it can be asserted that child psychology, the specialized discipline devoted to the study of child behavior and the various activities that we call by different names, can proceed *only at its peril* to study children in ignorance of these various processes of growth, development, maturation, and the various deficiencies in nature. Child psychology, if we may hazard a bold generalization, can justify itself as a separate discipline, promising valid scientific knowledge of children, only insofar as it is prepared to utilize its methods and procedures, its concepts, and its theoretical formulations, as one instrument along with all the other instruments that must be orchestrated upon the larger theme of child development. The other disciplines concerned with aspects of child growth and development are likewise faced with the same need to collaborate with others in the attempt to understand child growth and development, especially the child's behavior and personality expression (9).

Frank believes that the most hopeful and/or significant developments in child psychology are: (a) the growing interest in child development and larger concern for the study of child growth as reflected in increased interest in longitudinal studies of children; (b) the shift from a complete preoccupation with large statistical aggregates to a focus upon the growth sequence of individual organisms over a period of years, resulting in experimental methods whereby the individual's growth curve may be used as a norm in place of statistically derived norms; (c) the growing interest in the study of personality by means of projective techniques.

One of the most important problems now confronting the child psychologist is held to be that of "seeking ways of understanding personality development, the socialization of the child, and the operation of group living."

The problem of human behavior, or more precisely of human conduct, since human behavior is transformed by the operation of cultural traditions and child rearing into patterned conduct, begins to appear as the major problem of our time (13).

Frank gives the following suggestions which are worthy of the consideration by the younger students of child psychology: (a) become thoroughly acquainted with what has been done in the field; (b) recognize that data are only data which are not to be reified into entities; (c) recognize that every observation is to be ordered to the field in which it occurs; (d) become aware of the limitations of the quantitative method; (e) become aware of what child psychology may be able to contribute to social progress.

The reaction of many will probably be that this is the history of research in child psychology as viewed by the clinician. It is, from any point of view, a thorough, thought-provoking account that should receive the careful consideration of any student preparing to do research in child psychology.

The first half of the volume, in general, is particularly well adapted to the purposes which this volume is intended to serve. Methods and procedures dominate the discussion, while findings are subordinated. These studies give the student a picture of the rigid requirements of experimentation. The studies are samples of the best that has been done by investigators in the field of child development and set forth a high standard for research. The latter part of the volume is not so satisfactory from this viewpoint. There, scientific investigation is seen as it gropes its way into a comparatively virgin field where concepts are still in the process of formation and measuring instruments lack the exactness or preciseness of those used in the studies reported in the first part of the volume. It is quite possible that the concepts and measuring instruments now used will be found inadequate, certainly some of them will. The student must have a point of departure and, hence, it is necessary that he become familiar with what is being done in the field, even though some of the studies reported will have no permanently important place in the literature except as milestones in the development of research in personality and social development.

The first group of studies deals with early physical and motor development in children and includes a study on "Reflex Activities in the Human Fetus," Orvis C. Irwin's excellent study on "The Activities of Newborn Infants," which did so much by way of changing the conception of early action patterns in infants, H. M. Halverson's study on "The Development of Prehension in Infants," and a study of "Conditioned Responses in Human Infants."

"Mental Growth During the First Three Years" by Nancy Bayley, and Dorothea McCarthy's "Language Development of the Preschool Child" have substantial claims to a place in this volume as they are recognized as outstanding pieces of research. Both investigators have adapted their material to conform to the requirements of this volume. Both give a clear statement of techniques and procedures. It needs to be emphasized, particularly relative to these studies, that these reports will serve the needs only of those who desire a survey of methods and techniques of research in child psychology or who desire a general overview of the field. Any student who desires a thorough acquaintance with these studies needs to turn to the original reports of the research.

"The Development of Children's Concepts of Causal Relations," Jean Marquis Deutsche, represent investigations into children's thought modes, a field of investigation opened up by Piaget. This is a very difficult field to investigate and the reader will find here the approach that has been made to the problem but, without doubt, should raise the question as to the possibility of finding better methods of investigation.

The group of studies covering research on the problem of intelligence and intellectual development are, as a group, studies of importance yet, they are inadequate, we believe, in that they completely fail to give the reader any sense of the wide divergence of viewpoint, of bitter controversy, in fact, which characterizes this field of research today. That may not be the purpose of this volume, if the aim is to present only methods and techniques of research, yet, the student who is not aware of the conflicts involved, has little sense of the problems of research. The selections given here do, however, give a good view of current methods of investigating problems of intelligence and intellectual development. The study, "Growth in Intellectual Ability" by Frank N. Freeman and Charles D. Floy, is important in that it represents what may be a more fruitful approach to the problem. That is, it may be that more progress will be made if attention is focused on intellectual development rather than on intelligence. "The Stanford Binet Scales for Measuring Intelligence," Lewis M. Terman and Maud A. Merrill, is probably the best piece of work of this type that has been done and well deserves a place in this volume.

It is very difficult for the reviewer to evaluate or appreciate Jacob S. Kounin's "Intellectual Development and Rigidity." It is quite possible that the attempt to show differences in the degree of rigidity of psychological structure of normal children, adults, and feeble-minded will lead to fruitful results. It is a type of reporting that owes too close allegiance to geometry and it is difficult to see what psychology has to gain from that type of reporting. It also is not evident that human traits lend themselves readily to a formalized, graphic presentation.

It is well that this volume calls attention to Willard P. Olson's and Byron O. Hughes' "Growth of the Child as a Whole" since more approaches of this kind are needed to offset the too atomistic approach of much of child psychology. The study is highly suggestive of a valuable approach to child development.

The central group of studies are so well known and have exerted such great influence upon the development of child study that few would question their place in such a collection. They include "Learning and Maturation

in Identical Infant Twins," Arnold Gesell and Helen Thompson, "The Effects of Preschool Attendance upon Intellectual Development," Beth Wellman, "Foster-Family Resemblance in Intelligence," Barbara S. Burks, "Intellectual Growth of Children in Foster Homes," Marie Skodak, "Mental and Physical Traits of a Thousand Gifted Children," Lewis M. Terman. The latter study suffers from abridgment and the reader gains little more from it than a sense of possibilities in an investigation of that kind. Again, one who desired to investigate findings relative to gifted children would want to turn to Volumes I and III of *Genetic Studies of Genius*. The studies of Wellman and Skodak owe much of their importance to the storm of controversy which they have aroused. The reader gains nothing of that from this volume.

Three studies of emotional development are presented—Jersild's "Studies in Children's Fears" is an outstanding piece of research and represents the best in the field. The report given here suffers from brevity. The two studies of frustration report probings into areas that have not been well investigated. The first technique is represented as being presented "tentatively" as a possible method of handling the problem of reaction to failure. The second study is intended to test certain theoretical assumptions about regression. This study illustrates the use of free-play situations in child research and is a good presentation of research methods that are popular with many investigators. It embodies a type of psychological reporting which many find particularly objectionable since it is so heavily laden with theories which are none too clear to readers not indoctrinated in a certain type of theory. It is overburdened with statistics and charts giving the "topology" of a frustrating situation.

The remaining studies in the volume are devoted to personality and social development. Here, techniques and measuring instruments are not so well developed and much of the work is still in a pioneering stage. Many of the studies found in this group are to be thought of as suggestive, as indicating possible lines of investigation. Theories tend to overshadow methods and techniques.

"Study of Personality Development," Jean Walker Macfarlane, is an example of an extremely valuable type of research but one which few can carry on because of the cost and time required. It is a report of an incompleting investigation in which 252 children and their respective families had been followed for 14 years. The study is significant not only because of this but also because of the wide range of personality factors investigated, including the frequency and persistence of problem behavior during the pre-

school years, physical condition, size, rate of growth, intelligence, family variables in preschool years, reputation among classmates.

Several examples of the use of the observation technique are reported, among them "Social Behavior and Child Personality," Lois Barclay Murphy. This is an investigation into a relatively unexplored field, that of expressions of sympathy among nursery school children.

Only one study of motivation has been included, "The Effect of Barriers Upon Strength of Motivation," Herbert F. Wright. This is, in some ways, an excellent example of experimental work in that field although many will feel that better examples of work in motivation could have been selected. On the other hand, this study also is in many ways an excellent example of what should *not* be done in experimentation in child psychology. It is hard to see how the cause of psychology can be advanced by the methods used in this study and which are set forth in the following lines.

The main idea in a broad view of the method is that in order to predict behavior one must represent the *structure* and *dynamics* of the life space. Structure means the interpositional relationship of parts in a whole. Here, then, it means the spatial layout of the person together with all of the things that influence his behavior. By dynamics is meant forces causing change. A structural representation shows what behavior is possible and a dynamical representation shows what behavior has to occur.

In the diagrams that follow a geometry called *topology* is used to represent facts of structure. The diagrams also represent dynamical facts: valences and forces.

These conceptions are included in *topological* (structure) and *vector* (dynamics) *psychology*. It is important that this "psychology" is a *method* and not a "school" or a set of principles about behavior (380).

Several studies which make use of the play technique are reported in this volume. "Play and Substitute Satisfaction," Sybille Escalona, is a survey of a series of studies conducted at the University of Berlin, first on adults and then with children. The summary fits in well with the purpose of the volume in that it stresses objectives, technique, and experimental procedure. David M. Levy's "Experiments in Sibling Rivalry," is a statement of a clinical technique which has proved valuable to clinicians in gaining insight into the child's attitude toward various members of his family, consists of placing the child in a play situation with dolls representing the family constellation and allowing him to express himself freely. A third use of the play technique for the clinical study of children is found in Erik

Hamburger Erikson's "Clinical Studies in Childhood Play" which is condensed from "Studies in the Interpretation of Play."

Two studies, Harold H. Anderson's "Domination and Socially Integrative Behavior" and "The Social Climate of Children's Groups" by Ronald Lippitt and Ralph K. White, report attempts to measure the influence of adult leadership upon the child. Many questions might be raised relative to these studies, the primary one being that of validity.

The remaining studies are selected to illustrate various techniques for studying the social behavior of children. It is obvious, as one reads these reports, that research in this field is still, to a considerable degree, in the groping stage. One cannot but wonder what the status of these studies will be 15 or 20 years hence. The probability is that most of them will be considered very elementary if not completely inadequate.

Examples are given of the use of the observation technique in studying social behavior of nursery school children, of a sociometric test to measure personal interrelationships among girls, of the evaluation of adolescent personality by adolescents, of the use of a projective technique, the Thematic Apperception Test. Which of these techniques will prove of permanent value only time will tell, but one does appear to be justified in stating that there is some evidence in the studies cited that conclusions arrived at stretch the capacity of the measuring instrument.

"Development in Adolescence: A Case Report," Harold E. Jones, is a brief report of an excellent piece of work. Like so many of these studies it suffers greatly from condensation and by no means carries the force of the original report. It is a type of study of which more are needed. It is a careful study of the development and adjustment of a boy over a period of years.

Method is completely subordinate in the final two studies and must be inferred although, in view of the nature of the studies, the approach used may be the most desirable. They are brief summaries of extensive reports. The first by Allison Davis, "Child Training and Social Class" is taken from an extensive study, under the auspices of the American Youth Commission, of negro adolescents in New Orleans and Natchez. The second is Wayne Dennis' "The Hopi Child," which has been reported in detail elsewhere. The approaches used in these studies can well be repeated with other groups and should afford a fertile method for the study of the social development of children.

The readers can gain from the volume a knowledge of the aspects of

development which have been the subject of investigations in the study of child development. The techniques and procedures which have been employed in child psychology are well represented here. In addition, a reader who is interested in research in this field should find in this volume many leads for future investigations.

*Murray State Teachers College*  
*Murray, Kentucky*

## BOOKS RECENTLY RECEIVED

*(There will always be two pages of book titles, listed in the order of receipt, i.e., the most recently received books will be found at the end of the list.)*

- LINTON, R. (Ed.) *Science of Man in the World Crisis*. New York: Columbia Univ. Press, 1945. Pp. 532.
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